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on Canada's Economic Prospects

Output, Labour and Capital in the Canadian Economy

by Wm. C. Hood and Anthony Scott

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ROYAL COMMISSION ON CANADA'S ECONOMIC PROSPECTS

OUTPUT, LABOUR AND CAPITAL IN THE CANADIAN ECONOMY

FEBRUARY, 1957

By

WM. C. HOOD and ANTHONY SCOTT

While authorizing the publication of this study, which has been prepared at their request, the Commissioners do not necessarily accept responsibility for all the statements or opinions that may be found in it.

ROYAL COMMISSION ON CANADA'S ECONOMIC PROSPECTS

ERRATA SHEET FOR OUTPUT, LABOUR AND CAPITAL

Page	44	Table 2.17	1935,4th column - 12.034,9		should be	12,034.9
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"	421	Table 6B.1	1938 last col.	154,0	should be	154.0
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"	437	" 6B.3	1946 last column	1.955,8	" "	1,995.8
"	438	" "	1955 - 3294 construction	6.6	" "	366.8
"	446	" 6B.4	1938 - 7809	3430	" "	343.0
"	447	" 6B.5	1933 - 7001	1,428,9	" "	1,428.9
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"	454	" 6B.9	1941 last "	2,470	" "	2.470
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"	"	" 7D.2	1939 " 1	6.338	" "	6,338
"	507	" 7D.3	1929 last Col.	6.166	" "	6,166

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PREFACE

THIS STUDY is the work of many hands. It draws upon the fruits of other studies prepared for the Commission; it draws upon work, some of it published, some not, of government departments, especially the Dominion Bureau of Statistics. It reflects in the forecasts that are included many ideas from briefs presented to the Commission and from stimulating discussions with colleagues and other associates.

We should like to acknowledge above all the unstinting co-operation we have received from the Dominion Bureau of Statistics, especially from members of the Research and Development Division and the office of the Senior Research Statistician on whom we had to make our most extensive demands. We were greatly aided in our study of rates of membership in the labour force by a memorandum on the subject prepared in the Economics and Research Branch of the Department of Labour. We were generously assisted in our examination of investment expenditures by the Economics Branch of the Department of Trade and Commerce. In company with all members of the Commission's staff we benefited from the co-operation given our own librarian by several specialized libraries in Ottawa, notably those of the Department of Finance, the Bank of Canada and the Dominion Bureau of Statistics.

It will be apparent that we have drawn directly on the results of research conducted by several of our colleagues on the Commission's staff. This is especially true with respect to our discussion in Chapter 7 of the prospective distributions of national expenditure, saving and investment, and the division of the labour force and output by groups of industries. We would acknowledge in particular the assistance of Mr. J. C. Mills in preparing estimates of the employed labour force and hours of work by industry, 1926-55, and of Mr. R. W. Thompson in preparing material on past and prospective employment in the "government and community services" sector of the economy and on past and prospective receipts and expenditures of governments.

We have been allowed to make extensive use of unpublished material from several government departments. We should emphasize that we take full responsibility for the use to which we have put this material so freely placed at our disposal. Much of it is in preliminary form and will undergo extensive revision before publication by the departments concerned.

Although the two authors have collaborated in discussing and planning all parts of this study there has been a division of labour between us which

we should like to record. Chapter 2, "A Synoptic View of Growth" and Chapter 6, "The Accumulation of Capital", are primarily the work of Mr. Scott. Chapter 3, "Theory of Economic Growth", Chapter 4, "The Population and the Labour Force" and Chapter 5, "The Gross National Product and the Gross Domestic Product" are primarily the work of Mr. Hood, except that the estimates of Gross Domestic Product by industry, 1926-55, reported in Chapter 5, were made by Mr. Scott. Appendices D and E of Chapter 5 were also prepared by Mr. Scott. Chapter 7, as we have explained, records the results of many individual studies; it was drafted essentially by Mr. Hood.

We should like, in conclusion, to acknowledge the competent and patient help we have had from our two clerical assistants, Miss Helen F. Delahaye and Mrs. F. LaFortune, who, most of the time, worked under conditions of very considerable pressure.

1

INTRODUCTION

OUTPUT, labour and capital are three of the grand economic aggregates. Their interrelations and magnitudes over the last generation and over the next, in Canada, are the principal subjects discussed in this study.

Our assignment was to forecast the ranges within which the measures of population, labour force, output, expenditure, capital and certain of their constituent elements might be expected to lie. These forecasts are presented and explained below.

Throughout the course of our work we have continued to recognize and discuss with our colleagues the need for modesty and reserve in making and presenting such forecasts. The science of economics and related social sciences have, as they must, the making of predictions among their objectives. But the record of forecasting by economists and other social scientists, while not wholly unsatisfactory, cannot support sanguine anticipations of success. It is virtually certain that forecasts in these areas will be wrong in detail.

But while conscious of the limitations of the knowledge and methods at our command, we have felt that forecasts, regarded as efforts to appraise the future, are worthwhile. Many economic policy decisions have long-term effects. These decisions inevitably are based on expectations, whether the views of the future are explicitly worked out and recognized or not. There is therefore a strong argument for the proposition that the best strategy is to decide questions of economic policy in the light of explicit expectations based as carefully as possible on well-marshalled information from the record and on the knowledge and theory of the working of the economy that are available.

The foundations of the forecasts presented herein may be considered in three groups. First of all there are the broad assumptions as to the state of the world. By and large these rule out extremes of chaos and calamity and revolutionary changes in social organization. Next there is the theoretical

analysis of the interrelations among selected economic aggregates including those to be forecast. This analysis completes the framework of the forecast and suggests many of the methods to be used. Finally there are the detailed assumptions, in great variety, concerning factors particularly affecting each of the main variables.

The broad assumptions underlying the forecasts in this study are the following. It is assumed that there will be no global wars. A major holocaust would require the commitment by Canada and other nations of vast quantities of resources and might well lead to the utter devastation of all or large sections of the economy and the population. It is assumed that the colossal tragedy of a great depression, like that of the early 1930's, with its attendant human suffering and unrest, will be avoided. It is not assumed however that there will be no fluctuations whatever in economic activity. Similarly, it is assumed that the eroding force of inflation will be restrained. Finally, we take it to be our objective to consider the prospects for the Canadian economy and the main magnitudes that concern us in particular, under present government policies. Thus, while recognizing the likelihood of the introduction of some new projects and enterprises and the cessation of some present programmes, we have assumed there will be no major changes in the economic *policies* of governments in Canada. In view of the terms of reference of the Commission and the explicit assignment given to us, these seemed the proper and reasonable foundations to choose for the forecasts. It should be clearly understood however that we have not *predicted* that there will be no global wars, great depressions or major changes in government economic policies.

The general theoretical analysis underlying the forecasts is developed in Chapters 2 and 3. Chapter 2, largely empirical, gives a synopsis of the aggregative measures of economic growth and their relative changes. There are many dimensions to economic growth. The variety of its manifestations can hardly even be suggested in a single chapter, and indeed we might confess to having decided at one stage to give up the attempt. However, in reviewing the record of growth in so-called economically mature economies of the twentieth century, in particular the United Kingdom, the United States and Canada, we were impressed not only by the diversity of economic growth but also by the apparent stability over fairly long periods and in several countries of some of the relationships among aggregate economic indicators. To display and describe a selected group of these stable relationships is the chief purpose of Chapter 2.

The theoretical analysis in Chapter 3 concentrates on these observed regularities. It is there argued that economic behaviour in the short run is particularly variable but that in the longer run, with which we are concerned, certain equilibrating forces can be relied upon to restrain and keep within bounds some of the changes in the structure of the economy. The broad forces

of competition, the mobility of men and resources seeking to maximize gains and satisfactions, the memories of the consequences of past excesses, the tendency of gains (and losses) to spread throughout the economy, these equilibrating forces, and others, underlie the apparent stability of the relationships. Faith in the continued operation of these forces underlies our decision to rely heavily on the observed regularities in the record in making our forecasts. The regularities in economic relationships are not, of course, as pronounced as one might wish or as one might find in other fields of study, and we have therefore not been able to make our forecasts in a mechanical fashion. Moreover, we have recognized that life is lived in the short run and not in the long run and that the rates of growth of output, labour and capital depend intimately on the vigour with which opportunities are recognized and seized in the short run. But vigorous behaviour often leads to excesses, and it is thus that we come to have sympathy with the view that the faster growing economies often experience the more pronounced short-run fluctuations.

We do not believe that in Chapters 2 and 3 we have isolated and analyzed the mainsprings of economic growth. We suggest there that these are to be found deep in the social structure and in the aspirations and aptitudes of men. We have recognized the relationships among certain economic aggregates and offered an economic analysis of them. These regularities and our analysis underlie our forecasts, especially of output and capital.

In Chapter 4 the forecasts of the size of the population and of the labour force are presented along with a statement of the detailed assumptions and methods on which they depend. Among the plausible differences in assumptions, only those concerning the balance of immigration and emigration significantly affect the forecasts. We have therefore allowed the range of our population forecasts to depend solely upon differences in the assumptions concerning net immigration. If, over the next 25 years, net immigration into Canada should amount to 50 thousand persons a year, as it did on the average between 1945 and 1955, we shall have a population by 1980 of 25 or 26 million people. On the other hand if net immigration should amount to 100 thousand persons a year (ten thousand less than on the average from 1951-55) we shall have a population of 27 or 28 million persons in 1980. Detailed forecasts by sex and by five-year age group are presented in Chapter 4.

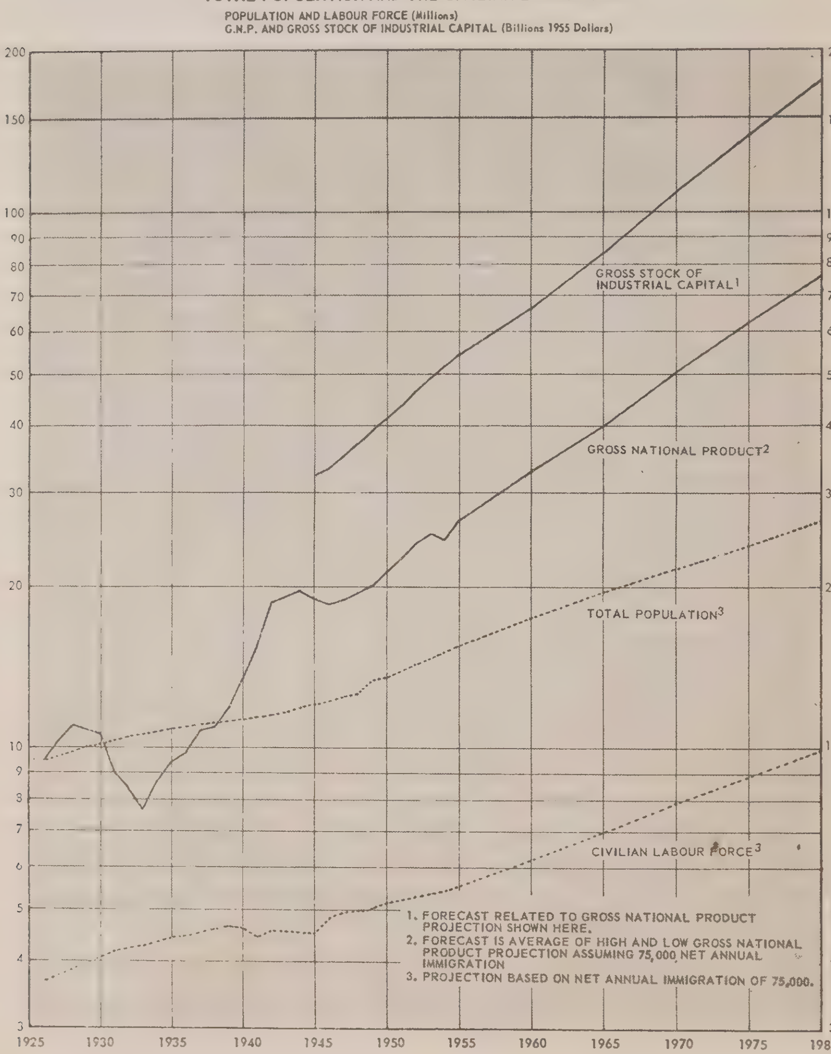
The most important consideration affecting the size of the labour force apart from the size and structure of the populaton itself is the rate of membership of the population in the labour force. Membership rates for each sex and for various age classes are discussed and projected in Chapter 4. Finally in this chapter, we present estimates of the distribution of the population and labour force among five regions of the country.

In Chapter 5, the forecasts of Gross National Product (G.N.P.) are given and explained. As part of the explanation, we survey the record of

output (measured as Gross Domestic Product—G.D.P.), employment and hours of work in Canada, as shown by estimates prepared especially for this study, for the years 1926 to 1955 for each group of industries in a grouping of all Canadian industry. Many detailed assumptions underlie the forecast of the G.N.P., but the most crucial of these concerns the average annual compound rate of increase of output per man-hour in what we have called the business sector of the economy. We have made alternative assumptions with respect to this important determinant, embracing within our range of 2½% to 3¼% per annum most of the extremes in our recent records.

GROSS NATIONAL PRODUCT, GROSS STOCK OF INDUSTRIAL CAPITAL, TOTAL POPULATION AND THE CIVILIAN LABOUR FORCE

Chart 1:1



1. FORECAST RELATED TO GROSS NATIONAL PRODUCT PROJECTION SHOWN HERE.
2. FORECAST IS AVERAGE OF HIGH AND LOW GROSS NATIONAL PRODUCT PROJECTION ASSUMING 75,000 NET ANNUAL IMMIGRATION
3. PROJECTION BASED ON NET ANNUAL IMMIGRATION OF 75,000.

A summary of the forecasts for 1980 of population, labour force and G.N.P. is shown in Table 1. 1 and Chart 1. 1, where it will be seen that if our assumptions prove approximately correct we may expect population to rise by 65% to 77%, the labour force to rise by 72% to 85% and the G.N.P. to rise by 175% to 221% between 1955 and 1980.

Table 1. 1

SUMMARY OF FORECASTS OF POPULATION, LABOUR FORCE AND OUTPUT IN 1980

		1955	1980					
			Net immigration at the annual rate of			Percentage increase from 1955 to 1980 net immigration at the annual rate of		
			50,000	75,000	100,000	50,000	75,000	100,000
Population [a]		15.6	25.8	26.5	27.5	65	71	77
Labour force [a]		5.5	9.6	9.9	10.3	72	79	85
G.N.P. [b]	Low		67.7	70.3	73.0	154	165	175
	Average	26.8	73.3	76.1	79.1	175	187	198
	High		78.9	82.0	85.2	197	209	221

a In millions.
b In billions of constant 1955 dollars.

In Chapter 6 we present estimates of the stock of capital, prepared especially for this study. Especial attention in this study is given to the stock of industrial capital, and our estimates of this magnitude are divided into machinery and equipment on the one hand and structures on the other. Detail for groups of industries is also provided. Forecasts of the stock of capital and of the annual rates of investment and depreciation are given and described. We have predicted that the total stock of industrial capital will grow slightly more rapidly than industrial output. The composition of this stock will change, however, so that the present preponderance of buildings or structures will give way to an approximate equality of plant with machinery. This will be accomplished by a decline in the proportion of Gross National Expenditure going into non-residential construction from 6.6% in 1955 to 5.2% in 1980 and an increase in the proportion going to machinery and equipment from 7.5% to as much as 10% (all ratios relating to figures expressed in 1955 prices). These predictions are based upon studies of capital-output ratios for the Canadian economy and assumptions about the future sizes of these ratios. The gross stock of industrial capital from 1945 to 1955 and as forecast to 1980 is depicted in Chart 1.1.

In Chapter 7 the division of the Gross National Expenditure (G.N.E.) (which is equal to the G.N.P.) into the principal classes of expenditure is discussed. Forecasts, described in detail in other studies prepared for the

Commission, are presented of expenditures by consumers and governments and expenditures on new capital goods, exports and imports. We also present a forecast of the division of national saving into personal saving, business saving, government saving, and the difference between exports and imports. Finally we present a forecast of the division of output (G.D.P.) and the employed labour force among eight groups of industries.

2

A SYNOPTIC VIEW OF GROWTH

I. Introduction

Perhaps the most confounding characteristic of economic growth is the multiplicity of its manifestations. We usually consider increases in output, population, and labour force, the stock of real assets with which to work, saving, consumption, energy use, output per head, the quality of goods, leisure, literacy, education of the population and decreases in poverty, the necessity for hard physical labour, the incidence of slum conditions and crime, all as manifestations of economic growth, and the list might be very greatly extended. It is fairly easy to quantify the changes in economic growth along some of its dimensions, more difficult along others and quite impossible along still others. It is therefore impossible to select a unique summary measure of economic growth and the phenomenon must be studied in its many dimensions.

Economic growth suggests different things to different people. The progress of an economy appears to many householders as an increase in the volume of durable goods or other treasured commodities that they may acquire with the fruits of their labour. To the businessman it may appear as an increase in demand for traditional goods and the appearance of opportunities for marketing new products. To the administrator it often appears as a series of new problems connected with the provision of roads, schools, sanitation and transportation facilities. Each is inclined to emphasize those features of economic growth that concern him most.

Our approach reflects the character of our assignment, which was to forecast the changes over 25 years in each of a group of aggregative statistical indicators of growth. Naturally our attention was concentrated early on dimensions of growth along which changes may be quantified. But even quantifiable indicators of growth are so numerous that further restriction of the scope of one's attention is imperative.

With this in mind we reviewed the record, especially the statistical record of economic change, not only for Canada but for other countries as well, and were gratified to find that some pattern in the statistics could be dis-

cerned albeit rather hazily in some instances. Having perceived a pattern and decided on its relevance for our purposes, we were from that stage forward able to focus our attention and efforts.

In this chapter we have two objectives: the first is to give a synopsis of the statistical record of growth, comparing Canadian data with statistics of the United States and the United Kingdom; the second is to display and discuss the pattern we think we see in the statistical record.

The pattern is summarized in the final part entitled "From Record to Theory", which introduces the theoretical discussion of the pattern in Chapter 3. In that chapter, in the final part entitled "From Theory to Forecast", we announce our intention, arrived at in the light of theoretical analysis, to place considerable emphasis on this pattern in the forecasting which is our main task.

II. Manifestations of Growth

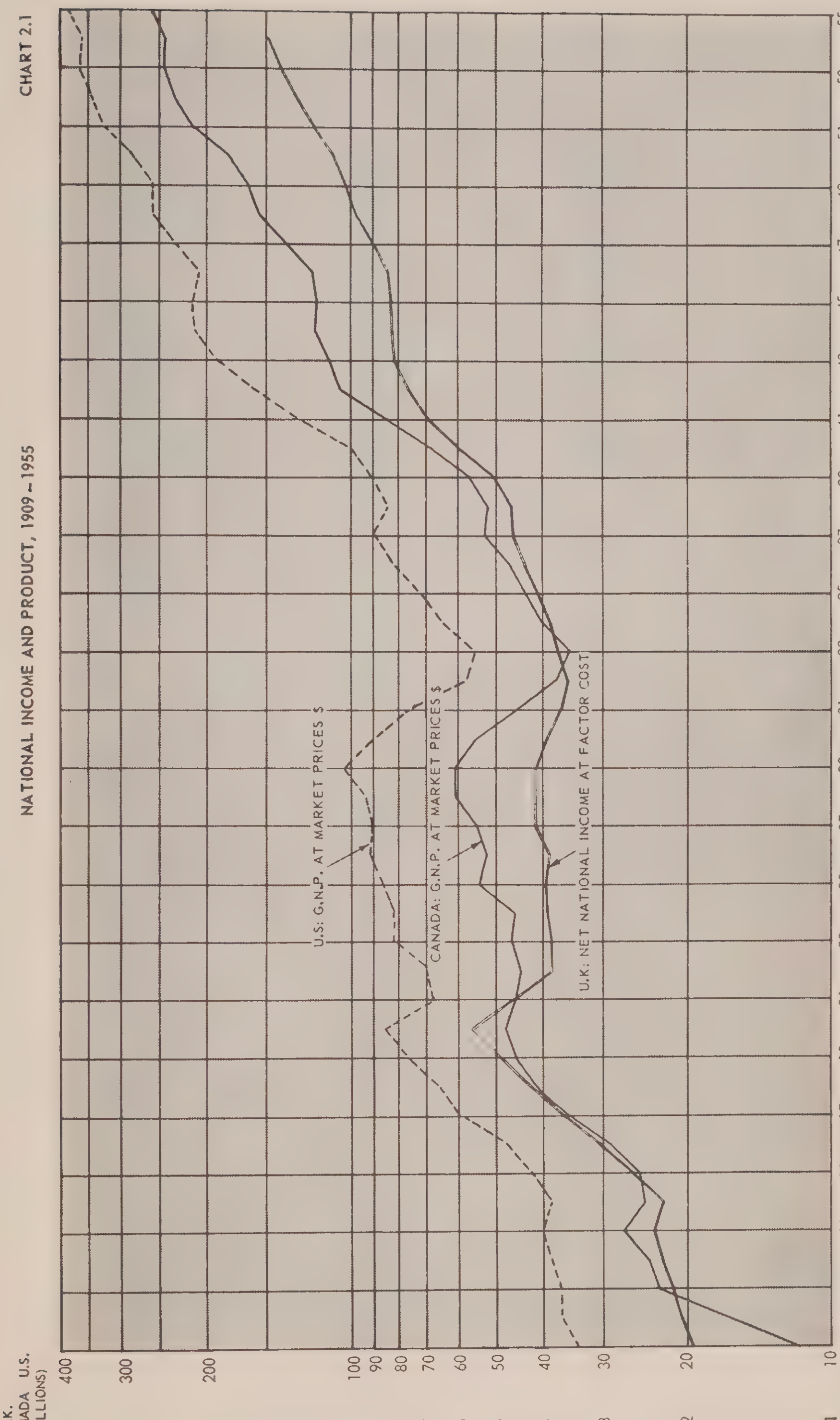
Our synopsis of the statistical manifestations of growth will begin with the aggregates mentioned in the title of this study: output, labour and capital. Our examination of each of these is designed not only to suggest how it behaves during growth, but also to provide, in some cases, opportunities to refer to "views of growth" which concentrate on these aggregates as focal points of theoretical systematizations of the development process. To confine our review, however, to alternative ways of thinking about these three aggregates alone would be to neglect the interesting and related patterns to be seen in the record of the consumption of resources and energy, the distribution of the national product between labour and property income, the population and income of geographical regions within the economy, and the flows and contacts which join national economic systems. We shall also, consequently, touch on each of these in turn.

1. *Output*

Among aggregative measures of national progress, the national output has long held precedence. From Adam Smith (who, in his *The Wealth of Nations* discussed much of what we would now call "income of nations") to writers inspired by such diverse thinkers as Thorstein Veblen and Lord Keynes, the national income, or the Gross National Product, has been the key variable to be explained, the summary number that epitomized the state of economic welfare, growth or stability. On the one hand, it is a measure of the total income received by those who supply factor services; on the other, of the total final value of the goods and services they produce. Hence a change in the national output may be, simultaneously, indicative of an increase in productive capacity, employment, in work done, in consumption, and in earnings; international comparisons of the national output should be indicative of the performance of one economy, relative to that of its neighbours, in achieving these desirable increases.

CHART 2.1

NATIONAL INCOME AND PRODUCT, 1909 – 1955



Source: Table 2.1

Table 2. 1

NATIONAL INCOME AND PRODUCT, 1909-55

	United Kingdom Net national income at factor cost £ million	United States G.N.P. at market prices $ billion	Canada G.N.P. at market prices $ million
1909........	1,973	34.0	1,169[c]
1910........	2,063	36.7	—
1911........	2,140	36.8	2,297
1912........	2,268	38.5	2,420
1913........	2,368	40.0	2,723
1914........	2,266	38.5	2,460
1915........	2,591	42.1	2,540
1916........	3,064[a]	47.8	2,910
1917........	3,631[a]	59.5	3,580
1918........	4,371[a]	65.5	4,000
1919........	5,461[a]	76.5	4,540
1920........	5,664[a]	85.0	4,800
1921........	4,460	68.5	4,574
1922........	3,856	69.9	4,490
1923........	3,844	81.6	4,690
1924........	3,919	82.0	4,600
1925........	3,980	86.4	5,480
1926........	3,914	92.3	5,294[b]
1927........	4,145	90.9	5,647
1928........	4,154	93.7	6,105
1929........	4,178	104.4	6,166
1930........	3,957	91.1[b]	5,546
1931........	3,666	76.3	4,560
1932........	3,568	58.5	3,767
1933........	3,728	56.0	3,552
1934........	3,881	65.0	4,034
1935........	4,109	72.5	4,345
1936........	4,388	82.7	4,701
1937........	4,616	90.8	5,355
1938........	4,671[b]	85.2	5,233
1939........	4,037	91.1	5,707
1940........	5,980	100.6	6,872
1941........	6,941	125.9	8,517
1942........	7,664	159.1	10,539
1943........	8,171	192.5	11,183
1944........	8,366	211.4	11,954
1945........	8,340	213.6	11,850
1946........	8,439[b]	209.2	12,026
1947........	8,929	232.2	13,768
1948........	9,889	257.3	15,613
1949........	10,466	257.3	16,462
1950........	10,939	285.0	18,203
1951........	12,014	328.0	21,474
1952........	13,179	346.1	23,255
1953........	14,064	364.5	24,473
1954........	14,865	360.5	24,317
1955........	—	387.2	26,769

See following page for footnotes.

If we examine the data for Canada, the United States and the United Kingdom (three countries which share many of the same economic characteristics and which trade together) we see first a persistent climbing of the G.N.P. curve, from the beginning of our records. In Chart 2. 1 it may be seen that, in spite of booms and depressions common to all three, and in spite of retardations and setbacks particular to each in turn, the curves are nearly parallel over long periods; on a semi-logarithmic chart such as this, parallelism means equality in percentage rates of growth.

We cannot, however, conclude that the three economies have therefore been growing at the same rate. In the first place, since these curves measure not only income increases, but also price level increases, they may give an illusory picture of rates of development. In the second place, since populations have been growing (and at different rates in each economy), the income-per-person curves rise at different rates than those showing incomes only. Furthermore, even in the absence of such obscuring simultaneous changes that may lead to possible misinterpretations of upward-sloping output curves, we should remind the reader that national output, being a very inclusive aggregate, is far from being a unique measure of growth. Not only the changes in the many subdivisions of output, as briefly discussed below, but also the concomitant changes in sociological, political and psychological welfare that cannot easily be evaluated with the measuring rod of money, must be individually considered. To deal with this last point is beyond our commission, but in the pages that follow we discuss briefly the adjustment of the national output measurement for the changing price level and the change in population, and we refer briefly also to the changing subdivision of the total national product.

FOOTNOTES TO TABLE 2. 1

a Very approximate.

b New series begins.

c Average for five-year period.

SOURCES: U.K.: 1909-45: A. R. Prest, "National Income of the United Kingdom, 1870-1946", *Economic Journal*, March, 1948, Table II.

1946-54: Central Statistical Office, *National Income and Expenditure, 1955* (G.N.P. at factor cost less depreciation as shown on page 66. See notes, p. 66).

See also J. B. Jefferys and D. Walters, "National Income and Expenditure of the United Kingdom, 1870-1952", in S. Kuznets, ed., *Income and Wealth,* Series V, Cambridge, 1955, Table I.

U.S.: 1909-28: J. F. Dewhurst and Associates, *America's Needs and Resources*, 1955, Appendix 4-2, Table A: "Gross national product . . . based on unpublished data from Simon Kuznets".

1929-53: U.S. Dept. of Commerce, *Survey of Current Business*, National Income Supplement, 1954 and February, 1956.

Canada: 1911-20: J. J. Deutsch, "War Finance and the Canadian Economy, 1914-1920", *Canadian Journal of Economics and Political Science*, November, 1940, pp. 538-39. Estimate here is total income produced plus net interest, etc. from abroad, plus an estimate of residential rents derived by carrying back a series for 1920-26 (below) on an index of the dwelling stock adjusted by the rent component of the cost of living index.

1921-25: *Monthly Review of Bank of Nova Scotia*, D. C. MacGregor, November, 1935, Table II. To "unadjusted national income" we added net income from abroad and rental value of homes. The estimates for 1921-25 were adjusted downward to link them with the official 1926 figure. This adjustment also brought the estimates into agreement with those of Kenneth Buckley, *Capital Formation in Canada*, 1955, p. 135.

1926-55: *National Accounts, 1926-1950* and *National Accounts, 1950-1955.*

First we may adjust national output data to attempt to remove the effects of the changing general price level, the increase of which is indicated by the indexes in Table 2. 2. It is surely unnecessary to defend the assertion that prices have been rising; few facts could be more familiar than that the purchasing power of a unit of currency has been secularly declining. This tendency was obscured by the nineteenth century's long low waves of increasing and decreasing prices, and by the rapid rise and slow decline during the 1920's; but underlying the whole long period we may discuss, in retrospect, mainly alteration between periods of more and less rapid price increase. Our table refers to Canada, but the American and British records would show the same tendencies.

Table 2. 2

CANADA: PRICE INDICATORS, SELECTED YEARS, 1871-1955

(1949=100)

	Consumer prices	Wholesale prices	Implicit price deflators: G.N.E.	Implicit price deflators: Non-residential construction
1871..........	—	41.0		
1881..........	—	36.5		
1891..........	—	33.8		
1901..........	—	32.1		
1911..........	—	40.9		
1913..........	49.2	42.1		
1921..........	80.9	72.3		
1926..........	75.9	65.7	69.3	60.2
1929..........	75.8	62.8	69.8	63.3
1932..........	61.7	43.8	56.7	54.0
1936..........	61.1	48.8	58.9	55.3
1941..........	69.6	58.7	66.5	63.3
1946..........	77.5	70.0	77.7	76.7
1949..........	100.0	100.0	100.0	100.0
1951..........	113.7	121.1	114.1	118.8
1955..........	116.2	109.4	122.3	131.8

SOURCES: Implicit price deflators: *National Accounts, Income and Expenditure*, various years, converted to 1949=100.
Wholesale and consumer prices: *Prices and Price Indexes 1949-1952*, Tables 1 and 20; and *Canadian Statistical Review*, 1955 Supplement, converted to 1949=100.

Although we shall, immediately below, adjust our G.N.P. series to remove the misleading impression of output growth given by such rising prices, we must admit that in so doing we may be destroying some of the most important evidence about economic growth. For economic growth may helpfully be regarded as a condition wherein a rapidly rising force of demand meets a lagging force of supply, so that in the markets for goods and services the excessive demand continually pulls prices upward. It is probable that such an environment of rising prices favours the implementation of new ideas and methods, and the exploitation of new discoveries; and the central part played in such circumstances by the inventor, the prospector, the innovator and indeed the commercial adventurer is not to be denied a place in

the pattern of economic growth. Yet even when this innovating role is properly emphasized, attention cannot be limited to statistical records of production measured in current prices, nor to the prices themselves.

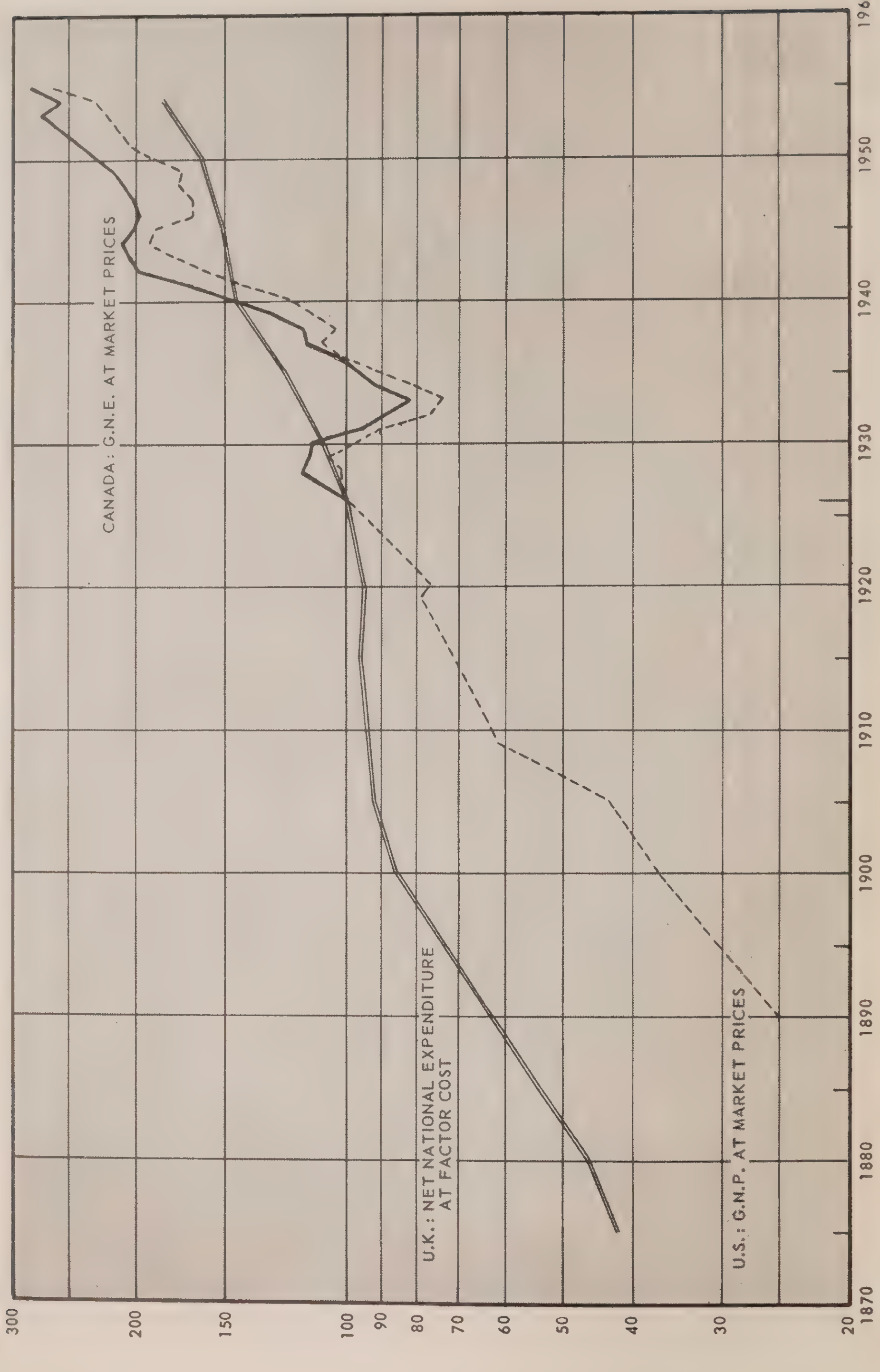
If the current-price G.N.P. figures be divided through by an index of prices, much of the effect of the price increase on the output measurement may be excluded. Although such deflation, as it is called, produces only an approximation to the measurement of the annual output as it would appear if prices did not change, it does help to provide a useful impression of the changing supply of real goods and services. We present measurements deflated in this way in Table 2. 3 and Chart 2. 2 for the same three economies. The statistics are shown as index numbers (based on 1926) in order to eliminate the confusion arising from the use of different currencies in the three countries. While the apparent harmony of the rates of increase of these measures of real national product (as revealed by the slopes of the lines on the semi-logarithmic chart) is not now as marked as it was for national product measured in current prices, there is nevertheless some evidence that the rates of growth of the real volume of national output in Canada and the United States have for significantly long periods been nearly equal. The rate of growth of output in the United Kingdom, however, now appears to have been somewhat slower than in the other two economies.

Such measures of the national output of a whole economy, adjusted for changes in the price level, are we believe among the most important and useful evidences of economic growth available. They have their shortcomings, of course. Not least of these is the unfortunate impression of uniformity conveyed by aggregates, concealing diverse simultaneous rises and declines of individual sectors and regions within the economy.

To some students of economic growth, indeed, the long-run changes in the division of the national output according to the industry (or group of industries) producing the various goods and services represented in the aggregate are so highly significant as to become the central subject of research, speculation and controversy. For example, it was argued by German economists of the nineteenth century that all economies passed through a series of stages which could be clearly identified by the predominance of certain types of economic activity at any given time. A related view has in our own time been espoused by Mr. Colin Clark in the *Conditions of Economic Progress,* London, 2nd edition, 1952, and the *Economics of 1960,* London, 1943, and by Mr. A. G. B. Fisher in *Economic Progress and Social Security,* London, 1946, and elsewhere. Their theories are based upon observation of such tables as 7. 9 and 7. 10, in Chapter 7, where the progress of the proportionate size of output, labour and capital in each of the main industrial sectors of the economy is set out, and upon the comparisons of the proportions with those in other countries. It will be seen, for example,

Chart 2.2

NATIONAL INCOME AND PRODUCT AT CONSTANT PRICES 1870 – 1955
(INDEXES 1926 = 100)



Source: Table 2.3

Table 2. 3

NATIONAL INCOME AND PRODUCT AT CONSTANT PRICES, 1875-1955

(indexes, 1926=100)

	United Kingdom	United States	Canada	
	Index of net national expenditure at factor cost [a]	Index of G.N.P. at market prices	Index of G.N.E. at market prices	Index of G.D.P. at factor cost
	(1)	(2)	(3)	(4)
1875....	42	—		
1880....	46	—		
1885....	54	—		
1890....	63	25 (28)		
1895....	73	—		
1900....	81	37 (41)		
1905....	87	43 (50)		
1909....	—	62[b]		
1910....	94	63		
1913....	—	68		
1915....	97	—		
1919....	—	79		
1920....	95	77		
1925....	100	—		
1926....	—	100	100	100
1927....	—	102	108	107
1928....	—	102	116	115
1929....	—	107	114	111
1930....	109	97	112	109
1931....	—	91	96	98
1932....	—	77	89	92
1933....	—	74	82	83
1934....	—	81	92	90
1935....	123	92	100	96
1936....	—	102	104	100
1937....	—	110	115	109
1938....	—	105	116	110
1939....	—	113	127	118
1940....	142	121	145	135
1941....	—	142	165	153
1942....	—	160	199	182
1943....	—	179	205	184
1944....	—	192	210	196
1945....	152	189	202	179
1946....	—	167	199	178
1947....	—	167	201	178
1948....	—	175	208	179
1949....	—	173	214	183
1950....	162[b]	190	228	195
1951....	—	203	241	208
1952....	—	211	257	218
1953....	—	220	267	227
1954....	183	225	258	221
1955....	—	263	283	240

See following page for footnotes.

that the proportionate size of agriculture has declined, while that of manufacturing has increased. This is congruous with the generalization of Messrs. Clark and Fisher that the pace of economic growth can be indicated by the rate of decline of the relative position of agriculture and by the simultaneous increases in manufacturing output and service industries' employment. Indeed, the rise of the service industries has become for some writers one of the most important aspects of economic progress. They argue that as the proportion of the labour force that is in agriculture declines, the rising income from manufacturing employment leads particularly to the simultaneous increase in the demand for such services as transportation, communication, trade, finance, insurance, government and personal services. That something like this has happened in Canada may be seen in Table 2. 4 wherein labour and output in the service industries, defined approximately as above, are shown to have grown faster than those of the whole economy. This, of course, does not prove the point; indeed the evidence of the percentages for gross fixed capital points in the opposite direction. We must postpone further discussion of individual industries; we wish here merely to illustrate the approach of those specialists who visualize the whole process of growth and development as a gradual movement of economic activity from the primary to the secondary and tertiary sectors of the economy.

Table 2. 4

SERVICES[a] IN THE CANADIAN ECONOMY

(percentage of total)

	1927-29 average	1945	1955
Civilian labour force	36.5	39.6	46.6
Gross domestic product	33.8	40.4	41.9
Gross fixed capital	n.a.[b]	66.5	57.2

a "Services" are here regarded as transportation, storage, communication, trade, finance, private services, civilian government and community services. Housing services—residential rents and the stock of houses—and armed forces are excluded from both "services" and the "total economy" in the calculation of these percentages.

b n.a.—not available.

SOURCES: Column 1: Chap. 7, Tables 7. 1 and 7. 2. Columns 2 and 3: Chap. 7, Appendices B and C. Chap. 6, Appendix B, Tables 6B. 2 and 6B. 5.

FOOTNOTES TO TABLE 2. 3

a Figures are for "centre years" of overlapping decades.

b New series begins.

SOURCES: U.K.: 1875-1952: James B. Jefferys and Dorothy Walters, "National Income and Expenditure of the United Kingdom 1870-1952", in S. Kuznets, ed., *Income and Wealth*, Series V, Cambridge, 1955, Table III.

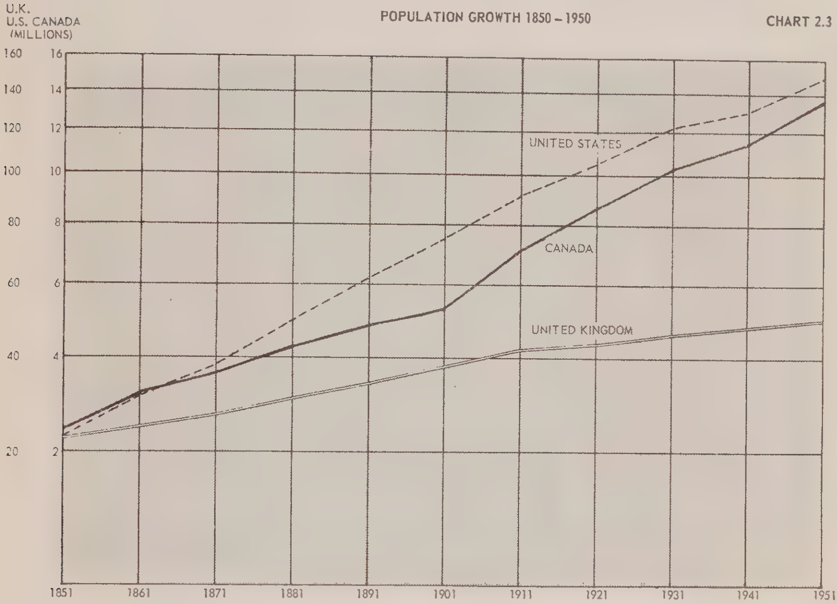
1952-54 (C.S.O.): *National Income and Expenditure, 1955*, Table 12.

U.S.: 1890-1920: Council of Economic Advisers, Appendix to *Report of Joint Committee on the Economic Report*, 1950, p. 84; 1909-55, *Joint Committee on the Economic Report*, 1954, p. 35. The parenthetical figures are alternative estimates from Raymond Goldsmith, *A Study of Saving in the United States*, Princeton, 1955, Volume III, Table N-2.

Canada: 1926-55 (G.N.E.): *National Accounts*, Table 3 (converted to $ 1949).

(G.D.P.): Chapter 5, Appendix F.

The dimensions of the growth of real national product of the economy and the divisions of it which may be examined, are legion—we shall consider other categories of output and expenditure below. We wish now, however, to turn to measures of the population and of the labour force.



Source: Table 2.5

Table 2. 5

POPULATION GROWTH, 1850-1950

Census Year	United Kingdom[a] Population (thousands)	United Kingdom[a] Annual increase (percentage)	United States[a c] Population (thousands)	United States[a c] Annual increase (percentage)	Canada[b] Population (thousands)	Canada[b] Annual increase (percentage)
1851	22,259	—	23,192	—	2,436	—
1861	24,525	0.97	31,443	3.09	3,230	2.86
1871	27,431	1.13	38,558	2.06	3,689	1.31
1881	31,015	1.24	50,156	2.66	4,325	1.60
1891	34,264	1.00	62,948	2.30	4,833	1.12
1901	38,237	1.10	75,995	1.90	5,371	1.06
1911	42,082	0.96	91,972	1.95	7,207	2.93
1921	44,023[d]	0.46	105,711	1.44	8,788	2.00
1931	46,062[d]	0.46	122,775	1.47	10,377	1.68
1941	—	—	131,669	0.70	11,507	1.04
1951	50,225	0.43	150,697	1.36	13,648	1.72

a U.N. Demographic Yearbook, 1955, T4.
b Chapter 4, Table 4. 1.
c U.S. data apply to 1850, 60, etc., not to 1851, 61, etc.
d Estimated by adding data for England, Wales and Scotland to a linear interpolation for Northern Ireland.

2. *Population, Labour Force and Productivity*

What has been the relation between changes in the supply of output and changes in the number of those who consume and produce it? There is much evidence on the rate of growth of population. In Table 2. 5 and Chart 2. 3 the rapid increase in the number of Canadians is compared with the growth of population in the United States and the United Kingdom. It is clear that the combined forces of net migration and of high birth rates and falling death rates have produced a net rate of increase for Canada higher than that of either the United States or the United Kingdom, at least since 1911. (Further discussion of population change for Canada alone is to be found in Chapter 4.)

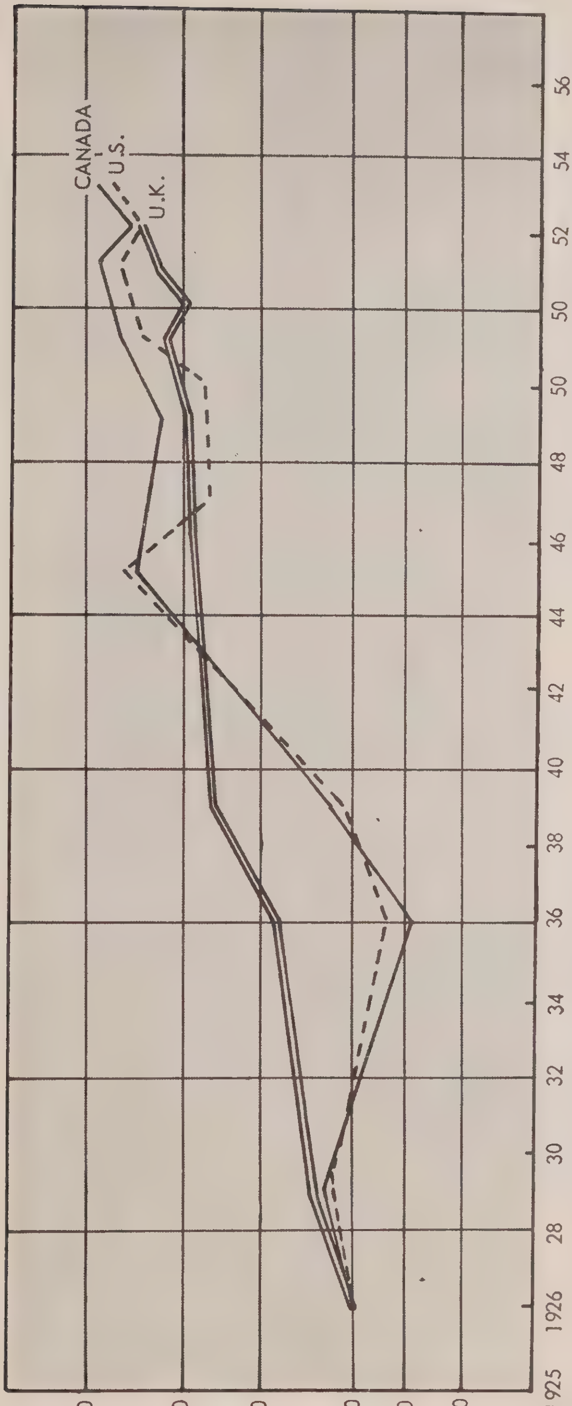
Has this increase been more or less rapid than the supply of goods available to feed, clothe, shelter and transport the population? This classic question may most easily be answered by reference to Table 2. 6 and Chart 2. 4, which show the ratio of real national expenditure to population for the three economies from 1926 to date. It will be seen that in all three countries the ratio has not only been rising, but at remarkably similar rates, especially as between Canada and the United States. The significance of the similarity in rates of growth of output per capita we must put aside for discussion in Chapter 3; for our immediate purposes it is sufficient to suggest that in these economies the increase of the ratio indicates there has been a faster rate of growth of output than of population.

The real output of the economy may be compared not only with the size of the population that uses it, but also with the size of that portion of the population that produces it. For the labour force is certainly not the whole of the population, nor is it even necessarily a constant fraction of it. To demonstrate this latter point we may begin with an important source of difference between population and labour force growth rates, namely, the changing age and sex composition of the population. Chart 2. 5 illustrates graphically how the percentages of the male and female populations in the various age groups (as indicated by the length of the bars) may change. The difference between the pleasing symmetry of the Canadian population pyramid in 1901 and its irregularity in 1951 is the outcome of a variety of forces: low birth rates in the 1930's; the recent arrival of immigrants in the age group 20-39; the falling death rate among infants and the increasing expectancy of survival in the age groups 70 and over.

The proportion of the population over 14 years of age changed from 65.7% in 1901 to 69.6% in 1951; the labour force is usually reckoned to be drawn only from persons 14 years of age and over. In Table 2. 7 we show comparative data on the labour force as a percentage of the population over 13 years of age. It will be seen that there has been no significant change in the United States' figures, but a perceptible decline in those for Canada. A

Chart 2.4

NATIONAL EXPENDITURE PER CAPITA



Sources: See Table 2.6

Table 2. 6

REAL NATIONAL EXPENDITURE PER CAPITA

(index 1926=100)

	United Kingdom	United States	Canada
1926	100[a]	100.0	100.0
1929	106[a]	103.4	105.4
1936	115[a]	93.8	88.9
1939	131[a]	101.5	105.2
1945	136[a]	158.7	156.9
1947	—	135.9	151.7
1949	138[a]	136.5	149.1
1950	142	147.1	155.4
1951	146	154.4	161.0
1952	140	157.7	166.9
1953	149	161.2	169.2
1954	154	156.1	159.2
1955	—	164.6	169.8

a These estimates are for central years of decades 1920-29, 1925-34, etc. The 1924-25 estimate has been adjusted upward for 1926=100.

SOURCES: U.K. 1926-48: James B. Jefferys and Dorothy Walters, "National Income and Expenditure of the United Kingdom, 1870-1952", in Kuznets, *op. cit.*, Table III.

1948-55: C.S.O.: *Annual Abstract of Statistics, 1955,* Tables 6 and 290 (population interpolated 1948-51).

U.S.: G.N.P. (in 1947 converted to 1949 prices) from U.S. Department of Commerce, Survey of Current Business *National Income Supplement 1954,* p. 216, divided by Bureau of Census estimates (for July 1) of population including overseas armed forces.

Canada: *National Accounts, Income and Expenditure 1926-50* and *1950-55* Table 3 (converted to 1949 dollars) divided by D.B.S. inter-censal estimates of population.

more detailed analysis requires examination of membership rates (ratios of labour force size to population) by age group and by sex; comparative figures for Canada and the United States are shown in Table 2. 8. It will be noted that in the United States the decline in labour force membership among younger and older men has been offset by an increase in the membership rates among women, particularly those whose families may be presumed to have grown up. In Canada this offsetting has not proceeded to nearly the same extent. Finally, we show ratios of the labour force to the entire population for Canada, the United States and the United Kingdom in Table 2. 9 and Chart 2. 6. These data reveal a rather remarkable long-run constancy as far as the United Kingdom and the United States are concerned, whereas the shorter run of figures for Canada suggest first an increase and then a decrease in membership rates.

If such evidence were all that were available we might be able to conclude that changes in output per capita would have much the same trend as output per worker since workers appear over the long run to be a fairly stable portion of the whole population. However, we must next recognize that while workers and total population seem to be increasing at about the same rates, the hours of work contributed by the workers are rapidly declining. Detailed evidence on this subject is to be found in Chapter 5 and we will not enlarge on it here. The data are summarized in Table 2. 10 which shows in column 1 the average weekly hours of work of employees in industry, excluding therefrom all government and community service.

Chart 2.5

PERCENTAGE DISTRIBUTION OF THE POPULATION BY FIVE-YEAR AGE GROUPS AND SEX, CANADA 1901—51

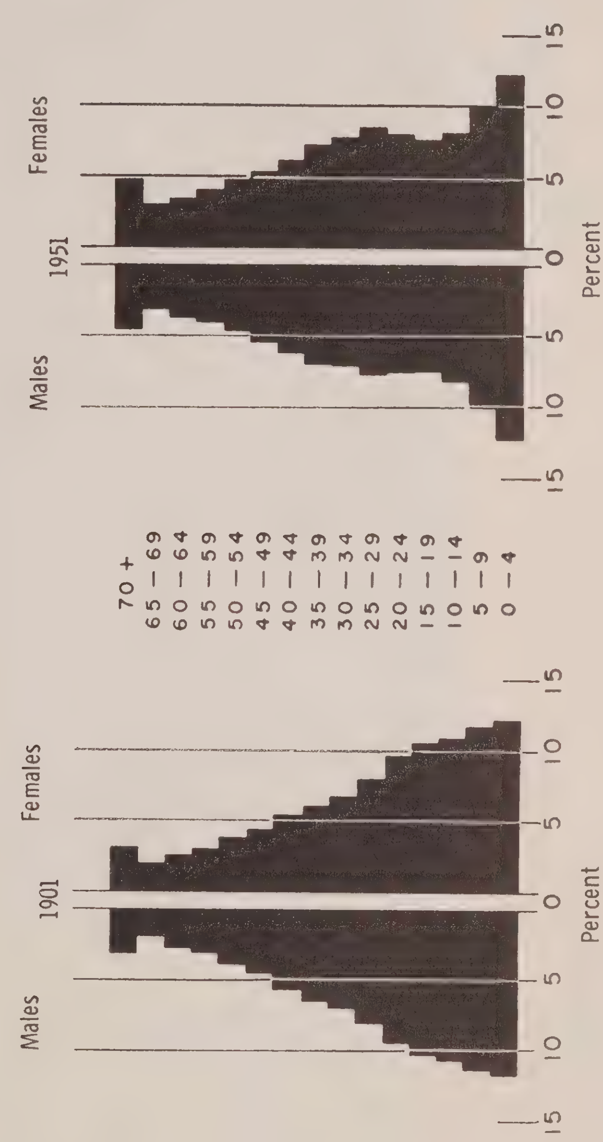


Table 2. 7

THE LABOUR FORCE AS A PERCENTAGE OF THE POPULATION 14 YEARS AND OVER

	United States	Canada
1929	56	—
1931	56	58
1939	55	57
1946	56	55
1949	57	54
1951	57	54
1953	57	52

SOURCES: U.S.: *Joint Committee on the Economic Report*, October, 1954, p. 33.
Canada: Ratio of total civilian labour force to non-institutional civilian population 14 years of age and over, *Canadian Statistical Review*, 1955, Supplement, 1931-45, June 1 estimates; 1946-53, average of quarterly or monthly estimates.

Table 2. 8

LABOUR FORCE MEMBERSHIP RATES

(percentage of age group in the labour force)

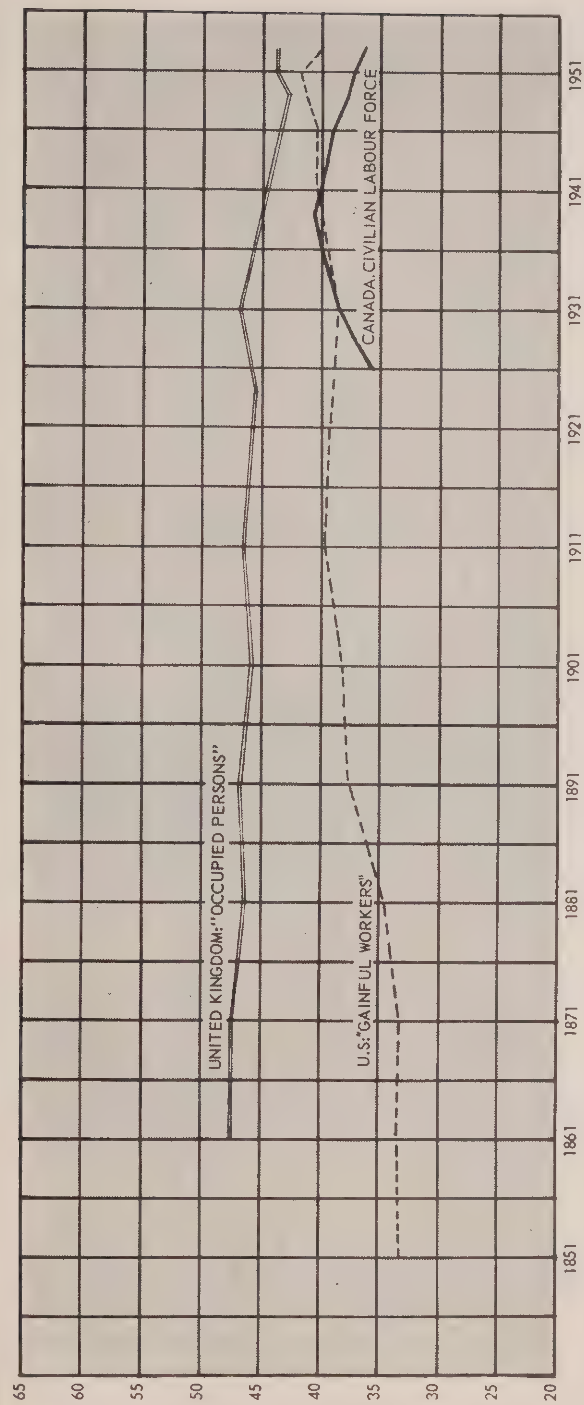
	Males			Females		
	14-19	45-64	65	14-19	45-64	65
(a) Canada						
1946	60.4	93.4	47.5	37.8	15.3	5.0
1949	58.1	93.0	42.9	35.1	15.4	4.7
1951	55.2	92.1	37.8	34.2	17.0	4.0
1953	51.7	91.8	34.6	33.1	17.2	3.6
1955	48.6	91.7	32.4	32.9	18.8	3.9
(b) United States						
1940	38.4	90.0E	43.3	19.9	21.6[a]	6.7
1950	47.5	91.0E	45.0	26.4	32.9	9.5

a Weighted average of rates for 45-54 and 54-64 using 1950 weights (from P-5031).

SOURCES: Canada: Chapter 4, Table 4. 21, below.
U.S.: Bureau of Census, *Current Population Reports*, P-50:42, p. 8.
The U.S. data differ from the Canadian in that they include the armed forces and the institutional population in the population aged fourteen or more.

CHART 2.6

THE LABOUR FORCE AS A PERCENTAGE OF THE POPULATION 1851 – 1953



Source: Table 2.9

Table 2. 9

THE LABOUR FORCE AS A PERCENTAGE OF THE POPULATION, 1850-1953

	United Kingdom occupied persons	United States gainful workers	Canada civilian labour force
1851	—	33.2	
1861	47.5	33.5	
1871	47.5	33.5	
1881	46.5	34.7	
1891	47.0	37.7	
1901	46.0	38.3	
1911	46.5	39.9	
1920	—	39.4	
1924	45.5	—	
1926	—	—	35.7[c]
1929	—	—	37.7[c]
1931	47.0	38.6	38.5
1939	—	—	40.6
1941	—	40.5	—
1946	—	—	39.4
1949	43.0[a]	—	38.0
1951	44.0[a]	41.9[b]	37.4
1953	44.0[a]	40.0	36.4

a Employed civilian labour force.

b Census civilian labour force.

c Civilian persons with jobs.

SOURCES: U.K.: Occupied persons, 1850-1911: Phelps Brown & Handfield-Jones, *Oxford Economic Papers*, October, 1952, from Bowley, *Wages and Income in the U.K.*; 1924-31: Phelps Brown & Weber, *Economic Journal*, June, 1953, from Bowley, *Studies in the National Income*. Employed civilian labour force, 1949, 1951 and 1953: *Canadian Statistical Review* from *Annual Abstract of Statistics*. Population: U.N. *Demographic Yearbook* 1955.

U.S.: Gainful workers, N.B.E.R., 1850-1940: Table D 47 *Historical Statistics of the United States*, 1945; Civilian labour force, 1950: Table D 15 *Historical Statistics of the United States*, 1952. Population: U.N. Demographic Yearbook. Data apply to 1930, 1940, etc. and not to 1931, 1941, as shown.

Canada: Civilian persons with jobs: Chapter 5, Table 5.1.; Civilian labour force: D.B.S., Reference Paper 23. (Data for June 1 to 1946, annual average thereafter.) Population: D.B.S., Reference Paper 40.

The pronounced decline in hours of work shown in the table may first be viewed as an increase in leisure. More leisure and more final goods and services are alternative fruits of improvement in the productive power of the economy. Let us attempt to measure the value of the leisure which Canadians have gained as their hours of work have fallen. We may borrow the method used by Simon Kuznets in his "Long Term Changes in the National Income of the United States of America since 1870." He described his method as follows:

> "The reduction in standard hours obviously means an increase in leisure. Since we cannot assume that the latter was 0 during the first decade, some estimate of leisure has been made—by assuming hours available for work and deducting them from the standard work week. The assumption made here is that the initial standard work week provided full engagement through six days of the week,

and that weekly leisure amounted to a sixth of the working hours. This implied that the maximum work week standard was 78 hours; and that the reduction in the work week would increase leisure, as standard hours would be subtracted from a constant diminuendo of 78."[1]

Table 2. 10

HOURS OF WORK AND "THE VALUE OF LEISURE"

	(1) Average weekly hours	(2) Estimated weekly leisure hours	(3) "Value of leisure" ($1949 million)	(4) "Value of consumption" ($1949 million)	(5) Value of leisure ÷ Value of consumption
1926......	55.1	22.9	3,358.7	5,065	66.3%
1927......	54.9	23.1	3,632.3	5,504	66.0
1928......	54.4	23.6	4,043.6	5,874	68.8
1929......	54.4	23.6	3,888.1	6,110	63.6
1930......	52.9	25.1	4,183.8	5,896	71.0
1931......	(52.6)	25.4	3,805.6	5,609	67.8
1932......	(52.3)	25.7	3,648.8	5,224	69.8
1933......	(52.0)	26.0	3,339.0	5,065	65.9
1934......	(51.7)	26.3	3,716.7	5,324	69.8
1935......	(51.4)	29.4	4,447.0	5,591	79.5
1936......	(51.1)	26.9	4,262.1	5,869	72.6
1937......	(50.8)	27.2	4,689.9	6,212	75.5
1938......	(50.5)	27.5	4,821.0	6,163	78.2
1939......	(50.2)	27.8	5,272.4	6,338	83.2
1940......	(49.9)	28.1	6,132.2	6,841	89.6
1941......	(49.8)	28.2	7,007.6	7,344	95.4
1942......	(49.5)	28.5	8,481.7	7,658	110.8
1943......	(49.2)	28.8	8,702.8	7,760	112.1
1944......	48.8	29.2	9,398.8	8,338	112.7
1945......	47.9	30.1	9,066.6	9,069	99.9
1946......	46.2	31.8	9,285.8	10,266	90.5
1947......	45.1	32.9	10,158.9	10,741	94.6
1948......	44.9	33.1	10,635.9	10,555	100.8
1949......	44.7	33.3	11,011.0	10,963	100.4
1950......	44.4	33.6	11,899.6	11,645	102.2
1951......	44.3	33.7	12,732.0	11,572	110.0
1952......	44.1	33.9	13,562.2	12,237	110.8
1953......	44.1	33.9	14,104.5	12,927	109.1
1954......	43.7	34.3	13,977.5	13,262	105.4
1955......	43.7	34.3	15,221.4	14,300	106.5

SOURCES: Col. 1: Chapter 5, (with interpolation 1931-44)—for industry only (excludes government and community services).
Col. 2: 78 hours — column 1.
Col. 3: G.D.P. x (Col. 2/Col. 1).
Col. 4: *National Accounts.*

Kuznets then assumed that the possible effects of the lack of leisure on the quality of labour and on technological advance would be small, and concluded that the value of an hour of leisure is equal to the value of an hour of work.

[1]Simon Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870", in *Income and Wealth of the United States, Trends and Structure,* Income and Wealth, Series II, Cambridge, 1952, p. 64.

In our own calculations, shown in part in Table 2. 10 we make the same assumption. For example, in 1926, since average weekly work was about 55 hours, the estimated weekly leisure was about 23 hours. In other words, leisure amounted to 41% of the hours of work. In column 3 we show this percentage of the Gross Domestic Product at factor cost for each year, which we may here label the "value of leisure". In column 4 we show the value of consumption in constant (1949) prices and in column 5, the percentage that our value of leisure is of the market value of consumption goods and services. It will be seen that column 5 rapidly approaches 100%. That it does so in 1949, the base year of our price indexes, is coincidental. While the basic assumptions made in this calculation are open to a good deal of question, and indeed are merely notional, it is inescapable that the choice of Canadians is increasingly in favour of taking part of their increased opportunities for income in the form of leisure rather than in consumption of goods. A more extreme and unqualified way of putting the conclusion would be to say that Canadians have now reached the point where the value of the leisure which they receive is equal to the value of consumer goods and services.

The foregoing discussion of hours of work has considered leisure as an alternative to consumption, which it undoubtedly is. Increased leisure may also be viewed as a lessening of the labour input into the industrial economy, and we now turn to examine the question: Has the total supply of hours put forward annually by the working population declined rapidly *per person?* We have already seen above that the number of workers, as a percentage of the population, has been declining in Canada but has been increasing slightly in the United States. As will be seen in Chapter 5, we believe that the Canadian working percentage will also increase in future years. At the same time as these changes in labour force in relation to the population have been going on, hours of work have been declining. We may then ask, what is the net outcome of these two forces? If hours of work have been falling, and the tendency of the population to belong to the labour force has also been falling, we must find a decline in the total annual supply of hours per capita offered to industry. On the other hand, if as in the United States there has been a tendency for the labour force to increase as a proportion of the population, it may be found that the supply of hours per capita actually rises.

A statistical answer to the question is offered in Table 2. 11 for the United States and Canada. In columns 1 and 4 the workers of labour force as a percentage of the population is shown. In column 2 we show the average hours of work. These hours have been generalized from industry or private business to cover the whole economy, including government. Columns 3 and 6 are indexes which show the supply of hours per capita over the whole period, taking 1949 as 100.

Table 2. 11

HOURS OF WORK AND "SUPPLY OF HOURS PER CAPITA"

	United States			Canada		
	(1) Workers as % of population	(2) Hours	(3) Supply of hours per capita (index)	(4) Workers as % of population	(5) Hours	(6) Supply of hours per capita (index)
1851......	33.2	69.8	138.6			
1861......	33.5	68.0	136.2			
1871......	33.5	65.4	131.0			
1881......	34.7	64.0	132.8			
1891......	37.7	61.9	139.5			
1901......	38.3	60.2	137.9			
1911......	39.9	55.1	131.5			
1920......	39.4	49.7	117.1			
1924......	—	—	—			
1926......	—	—	—	35.7	55.1	115.8
1929......	—	—	—	37.7	54.4	120.7
1931......	38.6	45.9	105.9	38.5	(51.0)e	115.6
1939......	—	—	—	—	—	—
1941......	40.5	44.4	107.5	—	—	—
1946......	40.5	42.6	103.2	39.4	46.2	107.2
1949......	41.5	40.3	100.0	38.0	44.7	100.0
1951......	41.9	40.5	101.5	37.4	44.3	97.5
1953......	40.0	40.1	95.9	36.4	44.1	94.5

e: estimated by extrapolation from 1930.

SOURCES: Columns 1 and 4: Table 2. 9.
Column 2: J. F. Dewhurst and Associates, *America's Needs and Resources*, 1955, Appendix 20-4, Col. 6.
Column 5: Estimated hours of work for industry, Chapter 5, Appendix F. This series excludes government and community services, but it is assumed here to cover those sectors.
Columns 3 and 6: Hours x (Workers/Population), with 1949=100.

Because the series is longer, the American data are perhaps rather more interesting. We see that there was from 1850 to 1930 a pronounced decline in index of the supply of hours per capita. Since that time, however, the decline has slowed, and it remains to be seen whether the evident increase in column 1 will overtake the decrease in column 2, so that the index in column 3 will commence to rise.

The outcome for Canada is very similar, although the index for 1931 is higher than that of the United States. Since 1940, however, the decline in the index has been very similar to that of the United States, although the values in columns 4 and 5 are quite different. We may anticipate that the ratio in column 4 will soon begin to rise as older workers remain on the job and women join the labour force. But the hours of work can be expected to decline to at least the present American level. (Incidentally, it is a matter of interest that the supply of hours per capita in absolute terms is almost the same for Canada and the United States for the period 1949 to 1955, although Canadian hours are higher and labour force membership is lower.)

We conclude that although the rate of increase of the population as a whole may not be too unreliable as an indicator of the rate of increase of the labour force, it is not, because of the decline in average hours of work per worker, a satisfactory indicator of the growth of man-hours of labour input in the economy. For this reason, in the discussion of the theory of growth to be found in Chapter 3 and in our forecasts in the succeeding chapters, we concentrate our attention as much as possible on the increase in the labour force adjusted for the change in hours of work.

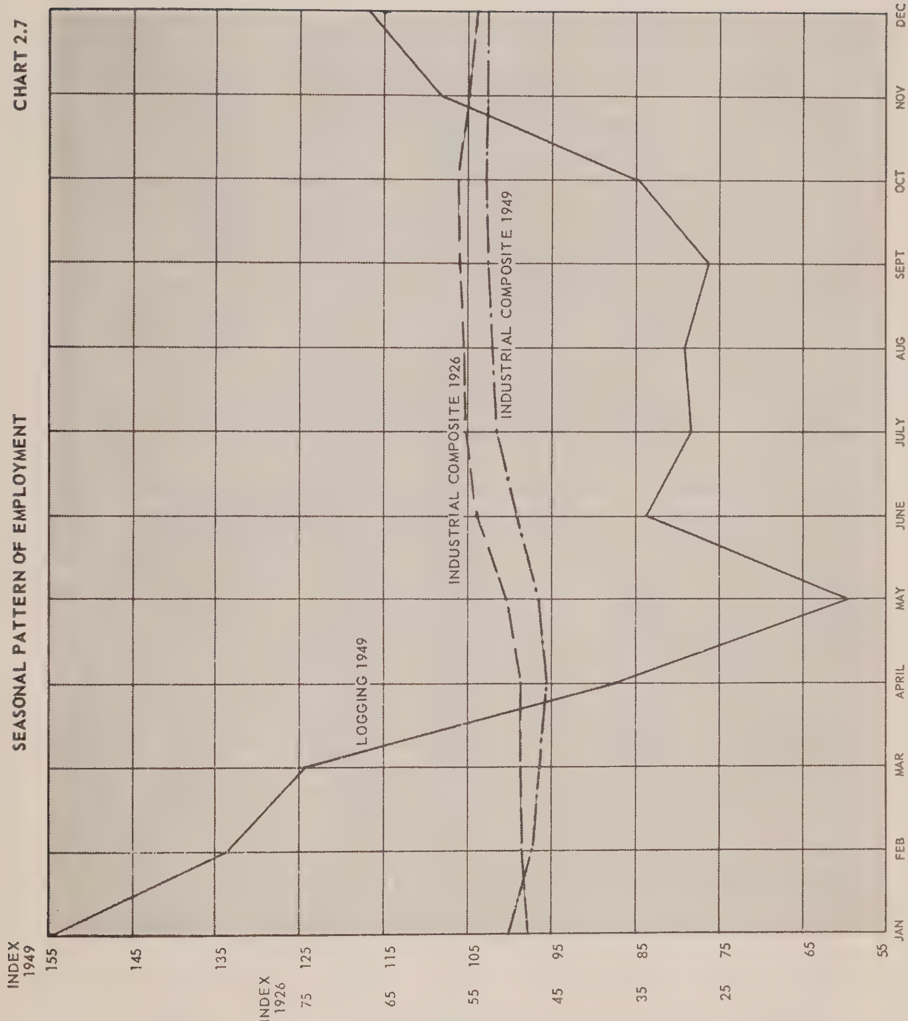
As a digression we should point out that the supply of labour in an economy like Canada, even when adjusted for changes in membership rates and in hours of work, is a faulty indicator of the supply of labour unless a further allowance is made for the seasonal nature of work in many industries. Chart 2. 7 shows the seasonal pattern of employment in 1926 and 1949 for a composite of the main Canadian industries. It is surprising that, although the levels alter, the pattern has not greatly changed. The widely fluctuating line shows the seasonal pattern of employment in logging in a recent year. The growth of the importance of many such seasonally affected industries means that there will probably long be a pronounced seasonal fluctuation in Canada's annual output. Seasonality may have two effects: on the one hand it may enable workers to work at alternate seasons in different industries; but on the other hand it may mean that larger numbers of people are temporarily without work while waiting for the appropriate season for their employment. But a digression on seasonality would require a serious diversion from our main theme and we can say no more about it here.

The title of the study refers to output, labour and capital; having now discussed the record of growth in the first two of these, we turn next to a derivative statistic, namely the ratio between output and man-hours of labour input. This ratio, output per man-hour, is often referred to somewhat incautiously as the productivity of labour.

Most researchers who have analyzed economic growth, whether with the object of forecasting or not, have made some use of estimates of output per man-hour. It is a key statistic, and we shall ourselves utilize it frequently in the chapters which follow. But output per man-hour for the whole economy is not an easy concept with which to work, largely because it is a ratio between two aggregates; its use seems to suggest that the entire experience of industry and the labour market in a given year can be reduced to a single number. Changes in the ratio actually reflect all the interrelated effects of changes in the population and in its age and sex composition, in the skills and aptitudes of the labour force, in hours of work, in the division of final demand between types of product, in the distribution of output and input among industries and regions, in the availability of resources and energy, in the march of technology, to mention but a few. In short, it is a summary statistic, useful just because it is a summary, but nevertheless characterized by changes that are exceedingly complex in source and difficult to interpret.

CHART 2.7

SEASONAL PATTERN OF EMPLOYMENT



SOURCE – D.B.S. Employment, Payrolls and Weekly Earnings, 1952. Table 4.

Table 2. 12

OUTPUT PER MAN-HOUR

	United Kingdom (Index, 1907 = 100)	United States (G.N.P. in 1953 dollars)		Canada (G.D.P. in 1949 dollars)	
	Chiefly manufacturing	Private	Private non-farm	Industry (includes farm)	Business (non-farm)
1907......	100M	—	—		
1908......	—	—	—		
1909......	—	—	—		
1910......	—	1.064	1.190		
1911......	—	1.072	1.220		
1912......	—	1.145	1.285		
1913......	114C	1.123	1.276		
1914......	—	1.131	1.290		
1915......	—	1.116	1.233		
1916......	—	1.130	1.268		
1917......	—	1.107	1.226		
1918......	—	1.112	1.244		
1919......	—	1.206	1.367		
1920......	—	1.205	1.381		
1921......	—	1.189	1.366		
1922......	—	1.284	1.474		
1923......	—	1.347	1.530		
1924......	142MR	1.372	1.583		
1925......	150C	1.442	1.657		
1926......	—	1.457	1.673	.78	.98
1927......	—	1.463	1.649	.80	1.00
1928......	—	1.463	1.666	.84	1.04
1929......	—	1.487	1.678	.77	1.02
1930......	—	1.443	1.649	.80	.98
1931......	—	1.482	1.709		
1932......	—	1.415	1.650		
1933......	—	1.383	1.620		
1934......	—	1.510	1.777		
1935......	—	1.621	1.884		
1936......	—	1.668	1.935		
1937......	—	1.717	1.974		
1938......	177CR	1.760	2.013		
1939......	—	1.816	2.072		
1940......	—	1.905	2.166		
1941......	—	2.007	2.240		
1942......	—	2.009	2.218		
1943......	—	2.029	2.245		
1944......	—	2.169	2.410		
1945......	—	2.242	2.486	1.12	1.41
1946......	—	2.148	2.346	1.11	1.38
1947......	190C	2.125	2.303	1.16	1.40
1948......	203MC	2.227	2.386	1.20	1.44
1949......	214E	2.302	2.478	1.22	1.45
1950......	222E	2.474	2.627	1.30	1.49
1951......	227E	2.485	2.652	1.36	1.51
1952......	222E	2.555	2.721	1.42	1.55
1953......	232E	2.641	2.804	1.46	1.61
1954......	244E	—	—	1.44	1.65
1955......	—	—	—	1.55	1.70

See following page for footnotes.

We mentioned that output per man-hour is sometimes referred to as the productivity of labour. It is a famous generalization in economics that *ceteris paribus* the average product of labour will decrease as the number of men employed increases. It has been a matter of anxious consideration by economists and statisticians whether the "other things being equal" qualification is an important one; that is, whether the change in the economic environment brought about by such forces as the progress of science and new resource discoveries are strong enough to offset the tendency to diminishing returns. The data we present in Table 2. 12 on output per man-hour in Canada, the United States and the United Kingdom suggest that the offsets are very powerful indeed. It is quite clear that in these countries there has been a continuing increase in output per man-hour; that is, that diminishing returns from existing resources, the shortening of hours and the reduction of labour force membership rates have been offset by the gains from advancing technology, resource discoveries and improving personal efficiency. Is there evidence of retardation in the growth of productivity per man-hour? Do the rates of growth fall over time? To put it another way, does the logarithm of output per man-hour, plotted against time on the horizontal axis, follow a straight line sloping upward or a trend that is gradually curving toward the horizontal? Examination of the data for all evidence of retardation or acceleration clearly calls for tremendous emphasis on details, refinement of statistical methods, and attention to the dating of inputs and outputs of various periods. (There is, as we have suggested, a large literature on the measurement and course of productivity within the three economies. The reader is referred to works by Rostas; by Phelps Brown and his associates; by Maddison; and by Burns, Kuznets, Kendrick, Abramovitz and other colleagues in the National Bureau of Economic Research. A rather impressionistic view of output per man-hour estimates for much longer periods can be obtained in Colin Clark.[2]) It was believed during the 1930's that the American economy was experiencing retardation in the increase of output per man-hour, but this belief was challenged by many statisticians;

[2] *The Conditions of Economic Progress*, 2nd ed., chart facing p. 280.

FOOTNOTES TO TABLE 2. 12

SOURCES: U.K.: Index of output per employee-hour in manufacturing from A. Maddison, "Output, Employment, and Productivity in British Manufacturing in the Last Half Century", *Bulletin of the Oxford University Institute of Statistics*, November, 1955, Table VIII. The items marked M are from this table. Those marked R are interpolations based on L. Rostas, *Comparative Productivity in British and American Industry*, Cambridge, 1948. Those marked C are interpolations based on Colin Clark, *The Conditions of Economic Progress*, 2nd. ed., London, 1951, pp. 269-270. Clark's figures apparently cover more than manufacturing; but it is doubtful that they cover all private non-farm as is suggested in U.S., Joint Committee on Economic Report, *Trends in Economic Growth*, Washington, 1955, p. 270. Items marked E have been estimated from the index of industrial production (Table 146), distribution of total manpower (Table 128) and hours worked in certain industries (Table 141 in C.S.O.: *Annual Abstract of Statistics 1955)* and linked to Maddison's 1948 figure. The coverage of these three series is not the same, particularly with respect to transport. All of them cover more than manufacturing: mining, building and utilities are also included.
U.S.: Joint Committee on Economic Report, *Potential Economic Growth of the United States During the Next Decade*, Washington, 1954, Table B-3, based on John W. Kendrick, "National Productivity and Its Long Term Projection", in *Long-Range Economic Forecasting*, New York, 1954; revised and extrapolated from 1951 to 1953
Canada: Chapter 5, Appendix F.

today the consensus is that whatever reverses took place in 1930 have been more than made good by the rapid increases since World War II. Some of the relevant evidence for this conclusion is summarized by the curves in Chart 2. 8. The Canadian data cover a rather short period, and are interrupted by the hiatus of the 1930's when data on man-hours were not collected. It appears, however, that Canadian experience has been much like that of the United States: though the rise of output per man-hour was interrupted by the onset of the depression, a subsequent acceleration has made retardation a matter of minor contemporary concern. Both countries' series also provide evidence of the gain in productivity made from the shift of farm workers to other occupations: this is the chief reason for the visibly more rapid increase of the over-all G.D.P. in Canada than of the non-farm G.D.P. The United Kingdom indicator covers little more than manufacturing, but in this limited sector the implication is also that the retardation in the inter-war period has subsequently been reversed.

The chart also suggests that while within the recent past the rate of growth per man-hour in Canada has been very high—probably higher than that in the United States—over the long run the two rates of growth of output per man-hour have been remarkably similar. We shall attempt to adduce a theoretical explanation of this similarity of long-run rates of growth in output per man-hour in the next chapter.

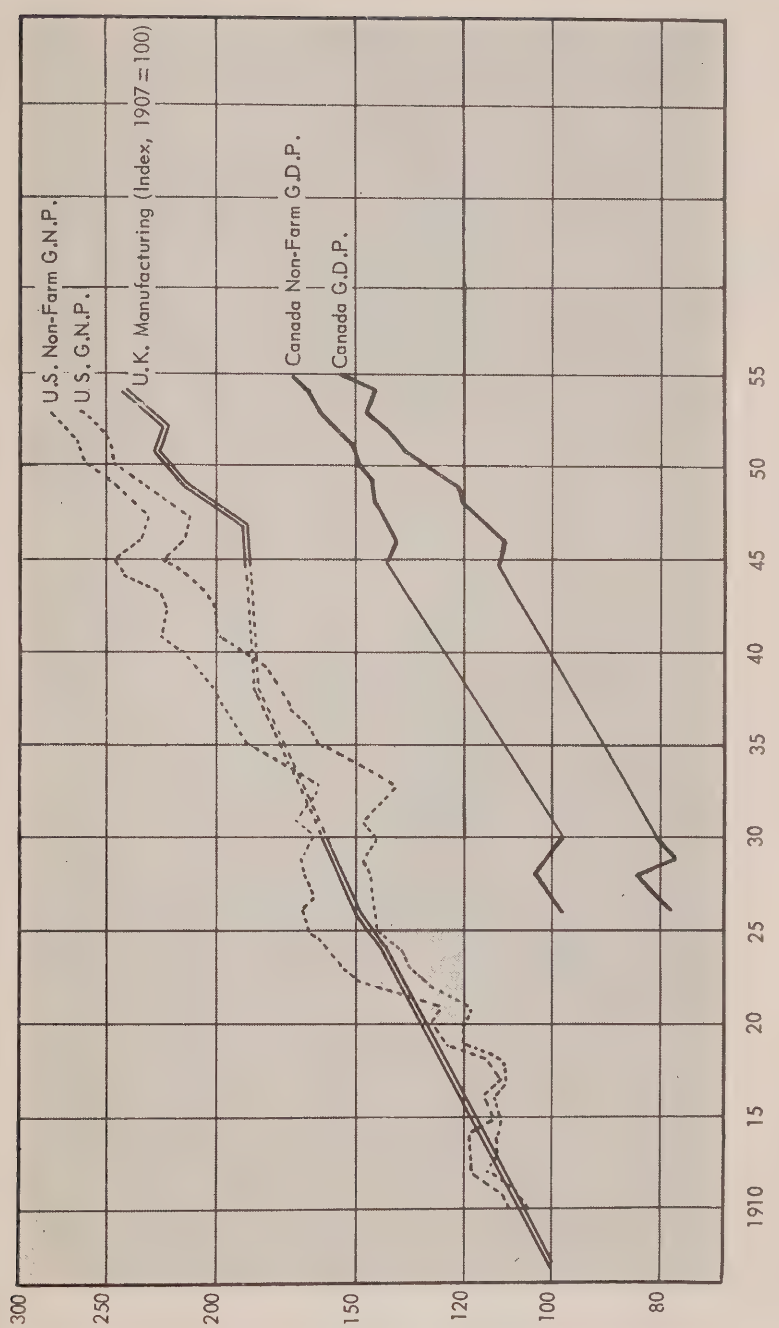
There is also evidence in the data, reflected in the interruptions of the slopes of the curves on the chart, that there may be slow cyclical movements in the rate of increase of output per man-hour. The Canadian series is too brief to support this hypothesis; but the American data suggest that these are long waves, each beginning with the introduction of a new technique, following through with the widespread adoption and adaptation of the new technique to differing enterprises, and finally tapering off as the varying possibilities of the invention become fully exploited. (In agricultural countries, such as Canada was in the early 1900's, the word "invention" should be interpreted broadly to include the discovery of new land and the realization of the possibility of new methods of transportation and agricultural production.) But whatever is the explanation of the cyclical waves in the path of output per man-hour, they should not be allowed to distract our attention from the pronounced upward trend of the series, the absence of retardation in the Canadian estimates, and the seeming similarity of growth rates in separate economies.

Another way of viewing the rate of output per man-hour is to look at the relationship between it and real wages. Economic theory tells us that in a perfectly competitive and static economy the real wage rate would correspond to the real marginal product of labour. We have no way of measuring these two variables with the precision required by such theory, but in Table 2. 13 we present two Canadian indicators of the real wage rate.

Chart 2.8

NON-GOVERNMENTAL PRODUCT PER MAN HOUR 1907–1955

Cents and Index



Source: Table 2.12

Table 2. 13

CANADA: REAL WAGE RATES, 1926-55

(index 1926=100)

	(1) Real labour income per hour	(2) Real general average wage rate—main industrial groups
1926	100.0	100.0
1927	103.2	103.9
1928	109.7	104.5
1929	112.9	105.2
1930	112.9	106.7
1931	—	114.4
1932	—	116.9
1933	—	116.3
1934	—	115.8
1935	—	118.6
1936	—	118.4
1937	—	123.4
1938	—	125.7
1939	—	127.2
1940	—	127.1
1941	—	130.6
1942	—	135.0
1943	—	143.9
1944	—	148.2
1945	190.3	152.0
1946	190.3	161.0
1947	203.2	164.6
1948	206.5	162.3
1949	216.1	164.5
1950	222.6	168.6
1951	232.3	172.2
1952	251.6	181.7
1953	271.0	189.8

SOURCES: Column 1: Canadian labour income including supplementary labour income from *National Accounts, 1926-55*, Table 21, divided by cost of living index *Canadian Statistical Review*, 1955. Supplement, Table 17 gives "real labour income". Real labour income divided by supply of hours gives an index of real labour income per hour (supply of hours from Chapter 5).

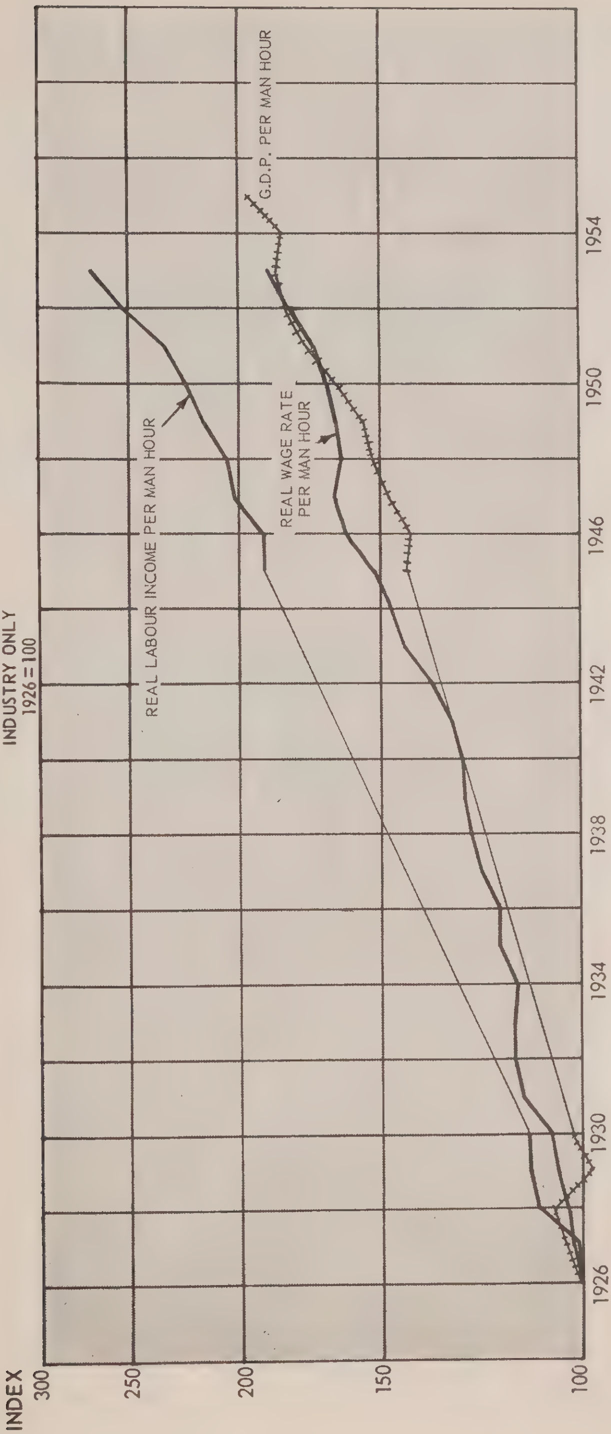
Column 2: *Canada Year Book*, 1955, p. 793, p. 650; converted to 1926=100, and divided by the C.O.L. index. See also *Wage Rates and Hours of Labour in Canada, Annual Report No. 37*, Ottawa, Department of Labour, October, 1954.

The first of the wage rate indicators, shown in column 1, is real labour income per hour, which we have calculated by working from national accounts' data on wages, salaries and supplementary labour income, and adjusting them for changes in man-hours and in the cost of living index. It will be seen that with 1926 as 100, this series—which, it should be emphasized, includes also salaries and supplementary labour income—rises to over 270 by 1953, indicative of a very real absolute improvement in labour remuneration. The other column shows the Department of Labour's general average wage rate index adjusted for the cost of living. This second indicator includes neither supplementary labour income nor salaries. Probably for these reasons its rate of increase over the period since 1926 is considerably less than that of real labour income per hour.

CHART 2.9

REAL WAGE RATES AND PRODUCTIVITY IN CANADA, 1926–55

INDUSTRY ONLY
1926 = 100



Source: Tables 2.12 and 2.13

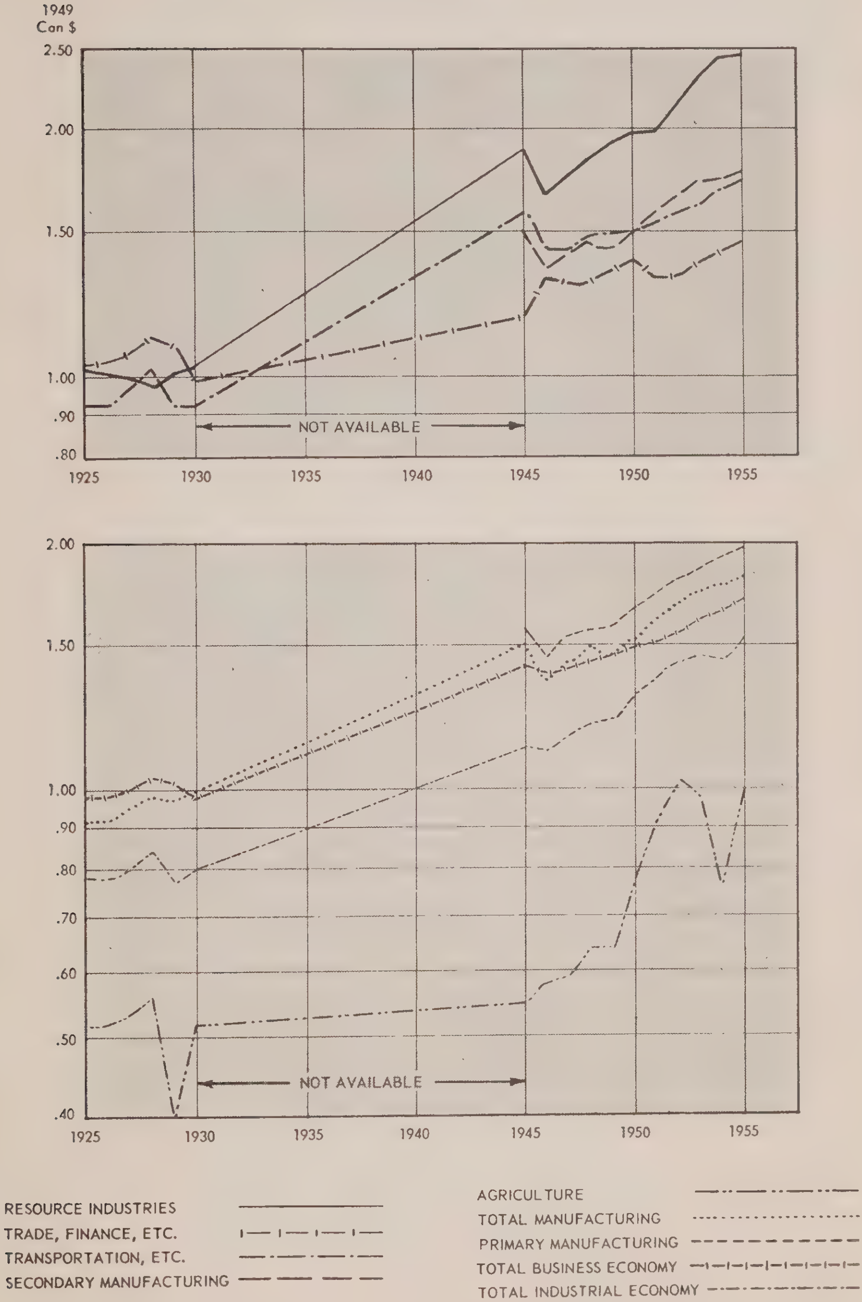
How do these two indicators of real wages compare with output per man-hour? This question may be considered with the aid of Chart 2. 9, which juxtaposes the two real wage series in the table and G.D.P. per man-hour for industry (that is, for the whole economy minus government departments, community services and residential housing). A quite remarkable parallelism is shown between the real wage rate series and output per man-hour, but the real labour income series is advancing more rapidly over time than the other two. The explanation for this diversity must be quite complex; it involves the difference between wages and salaries, and the difference between the price of the things which labour buys and the implicit price deflator for the output of the economy as a whole. (The latter has increased more rapidly than the former.) The exclusion of government from the G.D.P. series complicates the interpretation of the diverse movements of the three series; more important, the inclusion of agriculture, where the meaning of wages as against entrepreneurial income is vague, makes it impossible rigorously to compare the three series, even if time and resources were available.

Our general conclusion must be restricted therefore, to the rough but important observation that the growth of the economy has resulted in a pronounced and fairly constant long-run increase in national output per man-hour of labour, and that over the long run this increase in output per man-hour has been, broadly speaking, matched by an increase in real wages. This increase in real wages, however, has been slightly more rapid than the increase in output per man-hour (a point which is consistent with the demonstration offered below of the approximate constancy of the share of wages in the national income). Therefore, a view of growth, which identifies the growth of output per man-hour with the growth of real wage rates will not be far from the evidence of the historical record shown here.

A few paragraphs above it was remarked that total output per man-hour conceals the different rates of change of productivity in the various industrial sectors of the economy. Though we shall refer in Chapter 7 to changes in the relative size and growth of Canadian industrial sectors in some detail it might be useful to present in tabular form a comparison of the rates of growth of the main industrial sectors into which we have classified the Canadian economy. This is done in Table 2. 14 and in Chart 2. 10. These calculations suggest the effects on total productivity of the total labour force employed in each of the sectors and of the different levels and rates of growth of output in those sectors. This is not, however, the place to enter upon a technical discussion of inter-industrial shifts of employment and intra-industrial increases in productivity. We prefer here only to emphasize, again, what these differences in level and growth suggest: that total output per man-hour is a summary statistic *par excellence*. It summarizes, and may conceal, the effects of changing labour membership rates, changing population structure and changing hours of work, and is affected further by

CHART 2.10

GROSS DOMESTIC PRODUCT PER MAN-HOUR IN CANADA, BY SECTORS



Source: Chapter 5, Appendix F

RANKING OF SECTORS IN THE CANADIAN ECONOMY

Table 2. 14

		G.D.P. per man-hour						Average annual rate of increase in G.D.P. per man-hour				Change in numbers employed			
		1953-55 Average		1946-47 Average		1928-29 Average		1928-29/1953-55		1946-47/1953-55		1953-55 employment as % of 1928-29		1953-55 employment as % of 1946-47	
		Rank[a]	Amount	Rank[b]	Amount	Rank[c]	Amount	Rank[d]	Annual Rate of Increase	Rank[d]	Annual Rate of Increase	Rank[e]	% of 1928-29	Rank[e]	% of 1946-47
	Main Sectors		($)		($)		($)		%		%				
I	Agriculture	6	.91	6	.59	6	.48	2	2.58	1	5.96	6	69.3	6	73.6
II	Resource industries	1	2.42	1	1.71	2	.99	1	3.63	2	4.75	4	131.3	1	125.2
III	Primary manufacturing	2	1.92	2	1.50	2	.98(f)	2	2.40(g)	3	3.34	3	158.3	3	110.9
IV	Secondary manufacturing	3	1.74	2	1.38	2	.98(f)	2	2.40(g)	3	3.14	1	183.6	3	108.0
V	Transportation, storage and communication	3	1.67	2	1.42	2	.98	5	2.12	5	2.19	4	131.8	3	112.8
VI	Trade, finance, services and construction	5	1.41	2	1.31	1	1.10	6	.96	6	.97	1	177.9	1	130.0
	Small Sectors														
I	1. Agriculture	12	.91	12	.59	12	.48	4	2.58	1	5.96	12	69.3	12	73.6
II	2. Forestry, fishing and trapping	7	1.41	8	1.24	10	.82	7	2.19	9	1.73	11	98.4	7	106.2
	3. Mining	2	3.66	2	2.34	3	1.20	1	4.56	1	6.15	7	146.4	3	136.5
	4. Electric light and power	3	2.75	2	2.22	3	1.23	2	3.26	6	2.90	1	288.9	1	167.7
III	5. Primary manufacturing	4	1.92	4	1.50	7	.98(f)	5	2.35(g)	4	3.34	6	158.3	7	110.9
IV	6. Secondary manufacturing	5	1.74	4	1.38	7	.98(f)	5	2.35(g)	4	3.14	3	183.6	7	108.0
V	7. Transportation, storage and communication	5	1.67	4	1.42	7	.98	7	2.15	7	2.19	8	131.8	7	112.8
VI	8. Construction	7	1.48	8	1.28	3	1.21	10	.81	8	1.95	3	191.8	3	145.6
	9. Other public utilities	1	4.45	1	5.73	1	2.23	3	2.80	12	negative	8	133.3	1	160.0
	10. Trade — wholesale and retail	7	1.48	4	1.52	3	1.20	10	.85	10	negative	2	211.6	3	135.8
	11. Finance, insurance and real estate	10	1.18	8	1.20	2	1.49	12	negative	10	negative	3	198.8	3	132.0
	12. Services	10	1.03	11	.79	11	.70	9	1.56	3	3.61	10	122.9	7	108.6

a In this ranking differences of .15 or less were taken to be not significant.
b In this ranking differences of .20 or less were taken to be not significant.
c In this ranking differences of .30 or less were taken to be not significant.
d In this ranking differences of 0.20 per cent or less were taken to be not significant.
e In this ranking differences of 15 percentage points or less were taken to be not significant. These choices of insignificant differences are arbitrary.
f In 1928-29 figures are for all manufacturing; figures not available for primary and secondary manufacturing separately.
g Average for all manufacturing industry.

SOURCE: Chapter 5, Appendix F.

different rates of innovations in the various sectors of the economy, different rates of resource discovery and depletion, different stocks of capital and different attitudes to accepting risk or seeking security. It is a mistake to believe that output per man-hour is merely an indication of changing personal efficiency, skill or alacrity among workers. It is rather a summary statistic that in one way or another reflects almost every aspect of economic change. We shall make considerable use of it in the pages to come.

3. *Consumption, Capital Formation and Capital Productivity*

What, apart from increased leisure, have the economies gained from this increase in output per man-hour? The statistical evidence shows that although the production of consumers' goods and services dominates other types of output, each year's output is in fact composed not only of consumer and government goods and services for current needs but also of additions to and replacements for stocks of consumers' and capital goods which enhance the capacity of the economy to supply future output. Goods for current use or for the enlargement of the capital stock may also be acquired indirectly by trading exports for imports of foreign output. But current consumption commands the lion's share of domestic activity in the countries whose records we are studying: about two-thirds of each year's output takes the form of consumer goods and services and, if government services are included, the proportion rises to something of the order of four-fifths. Moreover, as may be seen in Table 2. 15, in the United Kingdom, the United States and Canada, the percentage of the current-price G.N.E. devoted to consumption goods has maintained a remarkable stability over the period since the data began.

It is true that the percentage seems gradually to be falling. This fact reflects the changing relative importance of particular items of consumer expenditure, the increasing importance of durable goods and some services and the declining importance of non-durable goods, especially some foods, and expenditures on shelter as well as on some services. (For further details the reader may consult the Commission's study *Consumption Expenditures in Canada*.) The declining percentage of G.N.E. devoted to consumption is not, however, an independent event. In examining Table 2. 15 we see that loss of consumption has actually been the counterpart of a gain in both government and investment expenditure. This is fairly easily explained, although the lines of connection are complicated by the intricacy of financial flows. As time has passed the disposable income of consumers has increased less rapidly than the national income owing to increased rates of direct taxation (providing much of the finance for government expenditure) and to an increased propensity of enterprise to retain rather than to distribute its earnings (thus providing savings for investment expenditure). For this reason a propensity of persons to save a constant ratio of disposable income is compatible with a declining ratio of total consumption to G.N.E.

DISTRIBUTION OF THE GROSS NATIONAL EXPENDITURE AT MARKET PRICES

Table 2. 15

(percentage of current-price G.N.E.)

	Consumption[a]			Gross investment[b]			Government expenditure[c]			Exports[d]			Imports[d]		
	U.K.	U.S.	Canada	U.K.	U.S.	Canada	U.K.	U.S.	Canada	U.K.	U.S.	Canada	U.K.	U.S.	Canada
1926	—	—	70.5	—	—	17.1	—	—	9.9	—	—	31.5	—	—	-29.0
1927	—	—	69.5	—	—	20.7	—	—	10.0	—	—	28.7	—	—	-28.9
1928	—	—	69.3	—	—	21.4	—	—	9.9	—	—	29.3	—	—	-29.9
1929	—	75.6	71.4	—	15.5	22.6	—	8.1	11.1	—	6.5	26.5	—	-5.7	-31.6
1930	—	77.9	76.0	—	11.3	16.3	—	10.1	13.9	—	5.7	23.2	—	-4.9	-29.4
1931	—	80.4	79.0	—	7.2	8.7	—	12.1	16.0	—	4.5	21.0	—	-4.2	-24.7
1932	—	84.3	81.8	—	1.6	3.8	—	13.8	16.9	—	4.0	21.2	—	-3.7	-23.7
1933	—	82.9	80.9	—	2.5	4.4	—	14.4	14.7	—	4.1	23.2	—	-3.8	-23.2
1934	—	79.9	75.2	—	4.4	9.2	—	15.0	13.9	—	4.4	24.9	—	-3.7	-23.2
1935	—	77.6	73.7	—	8.7	9.7	—	13.8	13.7	—	4.3	26.0	—	-4.4	-23.1
1936	—	75.7	71.7	—	10.2	10.8	—	14.3	12.4	—	4.0	29.6	—	-4.1	-24.5
1937	—	74.1	70.3	—	12.9	13.8	—	12.9	12.5	—	4.7	29.6	—	-4.6	-26.2
1938	76.3	75.8	73.0	11.4	7.8	11.4	13.4	15.0	13.8	16.9	4.9	26.0	-18.0	-3.5	-24.0
1939	—	74.2	68.5	—	10.2	16.4	—	14.6	12.9	—	4.6	25.5	—	-3.6	-23.3
1940	—	71.4	63.5	—	13.1	17.1	—	14.0	16.8	—	5.1	26.1	—	-3.6	-23.5
1941	—	65.1	59.0	—	14.4	15.5	—	19.7	19.7	—	4.6	28.8	—	-3.7	-23.0
1942	—	56.4	51.8	—	6.2	12.8	—	37.5	34.9	—	3.0	22.2	—	-3.1	-21.7
1943	—	52.2	51.1	—	2.9	6.5	—	46.0	37.7	—	2.3	30.7	—	-3.4	-26.0
1944	—	52.0	51.5	—	3.4	6.8	—	45.7	41.8	—	2.5	29.6	—	-3.5	-29.7
1945	—	57.0	57.1	—	4.9	6.1	—	38.8	31.0	—	3.3	30.2	—	-4.0	-24.4
1946	72.2	70.1	66.2	8.6	13.0	15.9	23.0	14.8	15.2	15.0	5.9	26.6	-18.8	-3.7	-23.9
1947	74.3	71.0	66.3	13.9	12.8	22.2	16.3	12.3	11.4	16.5	7.6	26.3	-21.0	-3.7	-26.2
1948	71.9	69.0	64.7	13.4	16.0	21.1	14.9	14.2	11.5	20.2	5.5	26.0	-20.4	-4.7	-23.3
1949	70.9	70.2	66.6	12.9	12.6	19.4	15.7	17.0	12.9	21.4	5.4	24.4	-20.9	-5.1	-23.3
1950	71.0	68.1	66.1	11.1	18.0	22.9	15.6	14.7	12.8	25.4	4.5	23.0	-23.1	-5.3	-24.8
1951	69.3	63.5	62.0	16.6	17.3	25.3	16.7	19.1	15.1	27.5	5.4	23.8	-30.1	-5.3	-26.2
1952	67.2	63.1	61.5	13.3	14.6	19.6	18.4	22.3	18.2	25.9	5.0	23.9	-24.8	-5.0	-23.1
1953	66.4	63.1	61.7	14.5	14.1	22.2	18.3	23.4	17.9	23.4	4.5	22.1	-22.6	-5.0	-23.9
1954	66.7	66.8	65.3	15.1	12.9	18.2	17.4	20.5	18.2	23.4	5.3	21.3	-22.6	-5.0	-23.0
1955	—	67.0	63.2	—	14.2	21.6	—	18.4	17.7	—	5.3	21.5	—	-5.0	-24.0

a Includes consumer durables.
b Includes residential construction and inventory investment, publicly owned business enterprises.
c Includes government direct investment.
d Includes invisible items. See note on U.S. sources.

SOURCES: U.K.: C.S.O. *National Income and Expenditure, 1955*, Table 1.
U.S.: *Survey of Current Business, National Income Supplement 1954*, pp. 22-23. The "net foreign investment" item has been divided between "exports" and "imports" on the basis of Table 11. Exports here include *net* factor incomes received; imports include *net* sales to U.S. government. Estimates for 1954-55 from *Survey of Current Business*, February, 1956, except exports and imports which are estimated from data in Table 3, March, 1956.
Canada: *National Accounts, Income and Expenditure, 1926-1950* and *1950-1955*, Table 2.

Consumption then, is the largest and perhaps most stable component of national output regardless of whether that output is growing or stagnant. What of the non-consumed, or saved, part of output? Some evidence for an answer to this question, in Canada at least, is to be found in Table 2. 16, which we may refer to as an extended version of the savings and investment accounts to be found in the published national accounts.[3] The principal change we have introduced is the addition to the table of government capital formation for civilian purposes. The first part of the table presents savings by source. It will be seen that, although much statistical and analytical attention is usually given to personal saving, in fact business saving (including depreciation allowances) is probably the most important single source of saving, followed by government saving (represented by government surplus and investment expenditures), then by personal saving, and finally by net borrowing abroad.[4] It will be seen that as the economy rises to cyclical peaks and as it undergoes the duress of depression and the rigours of war, while the ratios of each source of saving to G.N.E. change, total saving does not reveal any long-run change in its ratio. The fact mentioned just above, that personal disposable income is a falling ratio of G.N.E., suggests that personal saving should also be a falling ratio of G.N.E., and certainly the evidence is not inconsistent with this proposition.

Some saving originates abroad. Net borrowing abroad, represented by the difference between imports and exports of goods and services, appears to have been most important to Canada during the periods of its most rapid growth, financing both its increased capital formation and its taste for the somewhat more luxurious goods produced in other countries. In contrast, in depression, Canada appears to have been a net foreign lender; but it is as a borrower that she has made her mark in international financial histories.[5]

It appears then that Canadian economic growth has been characterized by a desire or need to set aside a large proportion of the G.N.E.—between 20% and 25%—for the purpose of capital formation. Comparison with other evidence such as that supplied by Simon Kuznets[6] suggests that this is a very high proportion and that capital investment in Canada runs far ahead of that in most other growing economies. Nevertheless, it appears also that there are quite wide differences in the investment ratio among countries, explained in part by their income and economic maturity: the rapidly growing and mature economies show the highest percentages, less rapidly growing countries such as the United Kingdom and France rather lower investment ratios, while, in the underdeveloped countries where low *per capita* incomes apparently render saving exceedingly difficult, investment ratios are

[3]See also Tables 7. 15 and 7. 16 in Chapter 7.

[4]However, much "foreign" lending is also included in statistics of corporate saving; an adequate differentiation between Canadian- and foreign-controlled savings by corporations in Canada is not yet available.

[5]Simon Kuznets, "International Differences in Capital Formation", Conference on Capital Formation and Economic Growth, New York, N.B.E.R., 1953.

[6]*Ibid.*, Appendix A.

Table 2. 16

CANADA: RATIO OF SAVING AND INVESTMENT TO THE GROSS NATIONAL EXPENDITURE, SELECTED YEARS

(percentage of current-dollar figures)

	Gross saving										Total Saving and Investment	New investment						
	Personal saving	Gross business saving				Government saving			Imports less exports	Error of estimate		Gross private fixed investment				Government non-defence investment	Inventories	Error of estimate
		Undistributed corporation profits	Depreciation, etc.	Other	Total	Receipts less expenditures	Non-defence investment	Total				Residential construction	Non-residential construction	Machinery and equipment	Total			
1926.	6.6	3.4	10.5	.3	14.0	1.1	2.0	3.1	—2.4	—1.2	20.1	4.0	4.5	6.9	15.3	2.0	1.7	1.1
1929.	3.2	3.4	11.5	—.3	14.6	.1	3.0	3.2	5.1	— .2	25.8	4.0	7.9	9.6	21.5	3.0	1.0	.2
1932.	—2.8	—4.6	15.0	—.7	9.7	— 7.4	3.4	— 3.9	2.6	.9	6.4	2.5	3.2	3.8	9.6	3.4	—9.1	— .9
1935.	1.1	1.6	12.0	—.4	13.1	— 4.0	2.9	— 1.0	—2.9	1.2	11.5	2.6	2.7	3.4	8.7	2.9	1.1	—1.2
1938.	3.1	2.1	11.1	—.1	13.3	— 2.9	3.2	.3	—1.9	— .1	14.7	3.0	3.3	5.3	11.6	3.2	— .2	.1
1941.	6.4	3.2	10.0	—.1	13.2	.7	4.5	5.3	—5.8	— .5	19.6	2.7	3.4	6.5	12.7	4.5	2.9	.4
1944.	16.5	2.9	8.0	—.1	10.7	—21.5	3.6	—17.9	.1	.5	9.9	1.9	2.2	3.2	7.2	3.6	— .4	— .5
1947.	3.1	4.5	8.1	.2	12.8	5.6	2.6	8.3	.1	.4	24.5	3.7	4.3	7.4	15.4	2.6	6.9	— .4
1950.	3.5	4.6	9.0	.4	14.0	3.6	3.3	6.9	1.8	— .1	26.3	4.4	5.6	7.6	17.7	3.3	5.3	.1
1953.	6.5	3.1	9.9	.1	12.9	.9	4.1	5.0	1.8	.1	26.3	4.3	7.0	8.5	19.8	4.1	2.5	— .1
1955.	4.9	3.4	10.7	.1	14.1	.4	4.7	5.1	2.5	.1	26.4	5.5	6.7	7.5	19.7	4.7	1.9	.1

NOTE: These estimates have not been adjusted for recent revisions in the G.N.E. discussed elsewhere in this study. The figure .1 stands for .1 or less.
SOURCE: *National Accounts, Income and Expendiutre, 1926-1950* and *1950-1955*, Tables 1, 16, 17 and 40.

very low. Such international differences are consistent with a striking uniformity within each country of the ratio of total capital formation to G.N.E. over considerable periods of time, such as are shown in our table for Canada. This uniformity over time of the ratio of investment to G.N.E. in the world economy is not conclusively indicative of a constancy of the savings percentage, for the investment of each of the countries of the world is not necessarily equal to its own savings as long as it is possible to import and export capital. However, in the following chapter and, indeed, in subsequent discussion, we shall emphasize the relatively constant relation between capital formation and national output.

We turn now from capital formation as a use of total output to capital as an agent essential in producing that output.

Until very recently it was necessary to analyze production without the benefit of statistical knowledge of the size and composition of the capital stock. However, the appearance of new data on capital formation has invited the making of estimates of the national capital stock by the "cumulation method". In Chapter 6 we shall present estimates of the stock of fixed industrial capital pertaining to the end of each year since 1926. Estimates of both the depreciated and undepreciated stock are shown in 1949 prices. For the purposes of comparison with estimates from other countries, we shall here discuss the depreciated or net stocks of capital.

Industrial fixed capital consists of plant, shops, dams, transmission lines, railroads, machinery and equipment. With the growth of the economies considered here the availability of saving and the increased demand for final output has induced business men to install more improved forms of capital, generally of a labour-saving variety. There has also been a direct and a derived demand for social capital, for housing and for larger inventories. Table 2. 17 presents for our three economies the fixed net capital in plant and machinery and equipment at constant prices for as long as consistent estimates are available. In each case the estimates are derived from a single source, so that within each country, at least, inconsistency of definition is avoided. The figures include not only industrial capital, but also social capital (housing, government and institutional stock). Since such enormous figures mean very little taken by themselves, we have presented them in relation to output as measured by the G.D.P. at factor cost.

The longest run of homogeneous estimates are those made by Dr. Raymond Goldsmith for the United States. The data for the United Kingdom are less plentiful. The high value for 1938 is probably more an indication of depression than of a consistently high capital-output ratio previous to World War II. Since the war, the ratio has been remarkably steady, and appears to have a rather higher value than that for the United States. (It is difficult, however, to make international comparisons of such global esti-

Table 2. 17

RATIO OF FIXED NET CAPITAL TO OUTPUT

(millions of pounds or dollars)

	United Kingdom: 1948 prices			United States: 1929 prices			Canada: 1949 prices					
							Net fixed capital				Ratio	
	Net fixed capital	G.D.P. at factor cost	Ratio	Net fixed capital	G.N.P. at factor cost	Ratio	Industrial	Social	Total	G.D.P. at factor cost	Industrial capital	Total capital
1897.....	—	—	—	79,262	30,195	2.6	—	—	—	—	—	—
1901.....	—	—	—	89,850	38,283	2.3	—	—	—	—	—	—
1906.....	—	—	—	110,609	48,272	2.3	—	—	—	—	—	—
1911.....	—	—	—	133,014	52,018	2.6	—	—	—	—	—	—
1921.....	—	—	—	167,317	64,828	2.6	—	—	—	—	—	—
1926.....	—	—	—	207,546	87,813	2.4	12,432.6	—	—	8,073.7	1.5	—
1927.....	—	—	—	216,701	88,448	2.5	12,642.7	—	—	8,627.7	1.5	—
1928.....	—	—	—	225,063	89,295	2.5	13,106.1	—	—	9,317.1	1.4	—
1929.....	—	—	—	232,652	96,145	2.4	13,751.8	—	—	8,958.8	1.5	—
1930.....	—	—	—	236,709	87,015	2.7	14,094.8	—	—	8,826.5	1.6	—
1931.....	—	—	—	236,916	77,334	3.1	13,999.9	—	—	7,879.0	1.8	—
1932.....	—	—	—	233,202	63,278	3.7	13,506.7	—	—	7,431.3	1.8	—
1933.....	—	—	—	227,971	62,399	3.7	12,913.6	—	—	6,677.9	1.9	—
1934.....	—	—	—	223,743	70,576	3.2	12,420.9	—	—	7,302.0	1.7	—
1935.....	—	—	—	221,663	79,361	2.8	12.034,9	—	—	7,774.4	1.5	—
1936.....	—	—	—	222,475	89,008	2.5	11,766.0	—	—	8,102.8	1.4	—
1937.....	—	—	—	224,809	96,059	2.3	11,692.8	—	—	8,766.2	1.3	—
1938.....	22,291	7,030	3.2	224,832	90,334	2.5	11,574.0	—	—	8,845.9	1.3	—
1939.....	—	—	—	226,411	97,371	2.3	11.402.2	—	—	9,516.9	1.2	—
1940.....	—	—	—	229,878	106,920	2.2	11,463.4	—	—	10,892.0	1.1	—
1941.....	—	—	—	234,872	127,623	1.8	11,699.0	—	—	12,380.9	.9	—
1942.....	—	—	—	234,518	133,728	1.8	11,899.9	—	—	14,725.1	.8	—
1943.....	—	—	—	231,917	149,055	1.6	11,830.8	—	—	14,876.6	.8	—
1944.....	—	—	—	228,834	154,114	1.5	11,907.5	—	—	15,717.1	.8	—
1945.....	—	—	—	227,914	152,432	1.5	12,955.8	14,976.9	27,932.7	14,437.2	1.1	1.9
1946.....	—	—	—	235,041	152,746	1.5	13,403.0	15,275.7	28,678.7	13,496.8	1.0	2.1
1947.....	21,173	9,844	2.2	244,560	153,357	1.6	14,358.0	15,714.9	30,072.9	13,935.4	1.0	2.2
1948.....	21,632	10,192	2.1	256,095	160,747	1.6	15,501.5	16,301.6	31,803.1	14,431.3	1.1	2.2
1949.....	22,162	10,620	2.1	266,806	158,556	1.7	16,643.7	16,959.9	33,603.6	14,779.9	1.1	2.3
1950.....	22,725	10,868	2.1	—	—	—	17,812.3	17,644.7	35,457.0	15,719.4	1.1	2.3
1951.....	23,244	11,317	2.1	—	—	—	19,053.6	18,275.2	37,328.8	16,730.6	1.1	2.2
1952.....	23,760	11,268	2.1	—	—	—	20,511.1	19,048.6	39,559.7	17,636.2	1.1	2.2
1953.....	24,427	11,689	2.1	—	—	—	22,304.6	19,955.8	42,260.4	18,341.3	1.2	2.3
1954.....	—	—	—	—	—	—	23,598.7	20,892.5	44,491.2	17,805.7	1.3	2.5
1955.....	—	—	—	—	—	—	24,766.9	22,126.0	46,892.9	19,390.3	1.2	2.4

SOURCES: U.K. Col. 1: Philip Redfern, "Net Investment in Fixed Assets in the United Kingdom, 1938-1953", *Journal of the Royal Statistical Society*, Vol. 118, 1955.
Col. 2: Central Statistical Office, *National Income and Expenditure 1955*, Table 12. 1938 estimated.
U.S. Col. 4: Raymond Goldsmith, *A Study of Savings in the U.S., op. cit.*, Vol. III, Table W-3, Col. 4 plus Col. 12.
Col. 5: Goldsmith, *op. cit.*, Table N-2. G.N.P.—(N.N.P.—NI); Col. 1: (Col. 2 — Col. 3).
Canada: Col. 5: Chapter 6, Appendix B, 1926-44; Table 6B. 3 — 8000 1945-55: Table 6B. 3 — 8000 plus Table 6B. 6 — 7000.

mates without personal consultation with the authors of the estimates.) When we look at Canada we find that the estimates which are roughly comparable with those for the other two economies begin only in 1945. The ratio of the net stock of industrial and social capital to the G.D.P. in 1949 dollars shows some stability in the postwar period, with an increase in recent years. Most of this increase is attributable to the very heavy Canadian investment in housing, which is included in the social capital column. In industry, however, there is also a fairly perceptible tendency for capital to rise faster than output. As a matter of interest we have shown in the same table and in Chart 2. 11 a highly speculative ratio between *industrial* capital only and the G.D.P. for the years from 1926 to 1945. It may be that the changes in this ratio are indicative of more inclusive changes in the over-all Canadian fixed capital-output ratio.[7]

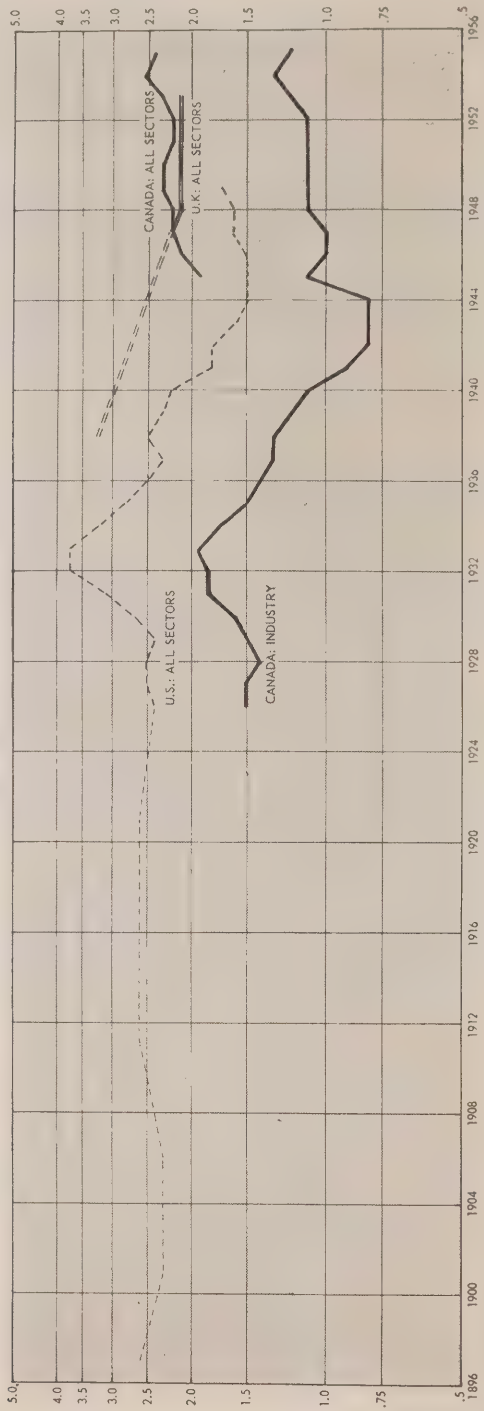
From these sources, from Appendix B to Chapter 6 and from the discussion of the long-run capital-output ratio in Chapter 6, it appears to us that the capital-output ratio has in all three economies been declining since the 1920's, but declining very slowly. This decline, it must be admitted, is obscured by violent cyclical movements in the ratio which reflect the appearance of excess capacity during the Great Depression and of over-utilization of capacity during World War II. Furthermore, this long-run decline not only appears to have been arrested in the last five or ten years, but to have been itself a reaction to an earlier long-term upswing of the ratio that began in the late nineteenth century. Indeed, we believe that the capital-output ratio is an approximately constant ratio in the long run in a growing economy; it is affected, however, by instability in its denominator over the cycle; and furthermore, it is subject to long and relatively gentle increases and decreases. These very long waves in the ratio are, it has been argued, reflections of changes in technology as between capital-using and capital-saving methods. Such changes in technique may result from changes in scientific and engineering knowledge available to industry and from the changing importance of various industries in the economy, some industries being heavy capital users, others depending mostly on labour for their output.

However, such fluctuation takes place around what appears, from our limited supply of data, to be a stable level of the ratio over a very long period. The evidence for such stability cannot, of course, be more than circumstantial and suggestive. But from it flows also our hypothesis, as will be explained in later chapters, that the change of the capital-output ratio is constrained by economic forces which create a "central tendency" about a fairly constant or normal level. These forces appear to have been in operation both during the relatively short business cycle and over the longer period during which basic structural changes occur. William Fellner has

[7]The same general pattern would be shown by our estimates of the gross capital-output ratio. See Chapter 6, Appendix B.

CHART 2.11

RATIO OF NET FIXED CAPITAL TO OUTPUT



SOURCE: TABLE 2.17

suggested that this long-run constancy is part of a process at work in capitalist economies which prevents radical declines in real wages or rates of return on investment, and thus allows harmonious growth to continue. He and other writers argue that the necessity of adjusting the industrial production process to the relative scarcities of labour, resources and saving has resulted in swings between capital-requiring and capital-saving innovations, the upshot of which has been a long-run capital-output constancy.[8] In Chapter 3 we discuss our belief that under neutral technological change, the capital-output ratio remains constant.[9]

We conclude that in economic growth the rates of increase of output and of capital may be equal, so that the ratio between them may not change over the long run. Having examined first the labour-output and then the capital-output ratio we now turned to the third ratio among this triad of variables: the capital-labour relationship. To many people economic growth is almost synonymous with mechanization and what is now called automation. Does mechanization actually correspond with an increased amount of capital per worker, or does the substitution of machines for men in some sectors lead to an off-setting growth of industries where much labour is used without machines—such as government and service industries? It appears that, while the trend has not been uniformly rising, there has been an increase in the ratio in the mature economies whose records we have examined.

Table 2. 18 and Chart 2. 12 show some scattered evidence on this point. (A warning in the footnote should be emphasized here, namely that these capital data are from diverse sources and refer to differently defined magnitudes, whereas Table 2. 17 was based on more or less consistently defined magnitudes for each of the three countries.) For the United Kingdom, Phelps Brown and Weber produce estimates which suggest that real capital per occupied person approximately tripled between 1870 and 1940; a somewhat slower growth in capital per head for persons in work was reported by Colin Clark, using many of the same sources as Phelps Brown. For the United States, Simon Kuznets indicates a tripling of capital per member of the labour force between the 1870's and the present day. When such estimates are adjusted for the shortening hours of work, the increase in capital per unit of labour is even more striking: the data in colmun 3 of the table might be interpreted as showing that in the United States the capital available per hour of work has increased almost five times since the 1870's. For Canada our data are available only since 1926 and even at that we are dealing with unverified estimates, especially in the inter-war period. However, it is quite clear that both capital per worker and capital per labour hour have increased greatly since 1926, although most of this increase has taken place since World War II.

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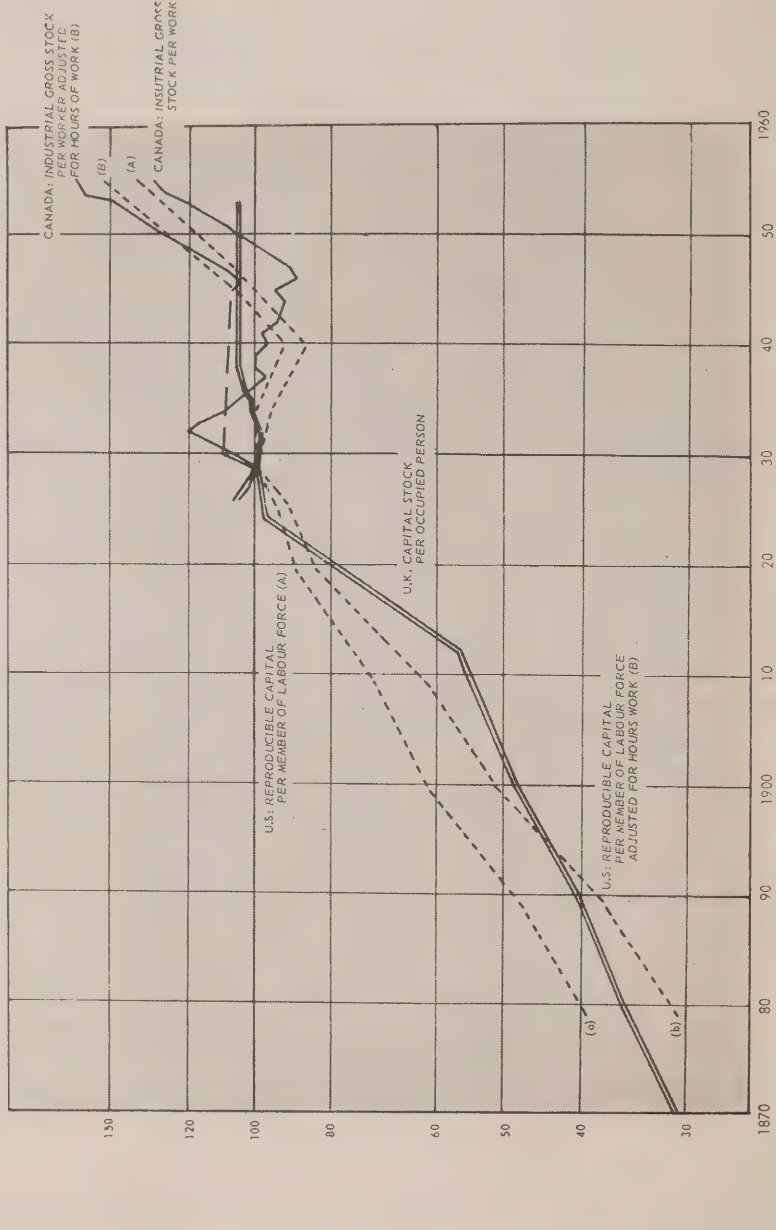
[8]See William Fellner, *Trends and Cycles in Economic Activity*, New York, 1956, Chapter 8, and Part III, *passim.*

[9]Neutral technological change is consistent with the adoption of inventions that permit changed ratios of labour to capital.

Chart 2.12

CAPITAL PER WORKER AND PER HOUR OF WORK
INDEX, 1929 = 100



Source: Table 2.18

CAPITAL PER WORKER

Table 2. 18

(index 1929=100)

	United Kingdom	United States		Canada	
	Capital stock per occupied person	Reproducible capital per member of labour force	Same, adjusted for hours of work	Industrial gross stock per worker	Industrial gross stock per hour
	£1912	$1929	$1929	$1949	$1949
1870.......	30.8	—	—	—	—
1879.......	—	39.5	30.4	—	—
1880.......	35.3	—	—	—	—
1889.......	—	47.2	37.5	—	—
1890.......	40.5	—	—	—	—
1899.......	—	60.6	49.8	—	—
1900.......	48.5	—	—	—	—
1909.......	—	71.0	61.5	—	—
1910.......	55.1	—	—	—	—
1912.......	56.7	—	—	—	—
1919.......	—	88.4	83.3	—	—
1924.......	97.2	—	—	—	—
1925.......	97.6	93.7	90.0	—	—
1926.......	97.9	—	—	107.1	105.6
1927.......	98.8	—	—	103.4	102.1
1928.......	99.5	—	—	100.7	100.4
1929.......	100.0	100.0	100.0	100.0	100.0
1930.......	99.8	—	—	106.6	109.4
1931.......	98.8	—	—	113.5	—
1932.......	98.6	—	—	120.6	—
1933.......	100.0	—	—	117.5	—
1934.......	101.4	95.1	99.3	109.6	—
1935.......	102.1	—	—	105.8	—
1936.......	103.1	—	—	100.5	—
1937.......	104.7	—	—	96.8	—
1938.......	105.2	—	—	100.1	—
1939.......	—	—	—	99.2	—
1940.......	—	87.2	92.1	96.9	—
1941.......	—	—	—	98.1	—
1942.......	—	—	—	94.3	—
1943.......	—	—	—	92.9	—
1944.......	—	97.1	102.5	92.5	—
1945.......	—	—	—	95.0	107.7
1946.......	—	—	—	89.2	104.7
1947.......	—	—	—	91.1	109.4
1948.......	—	—	—	96.1	116.2
1949.......	—	114.1	—	100.6	122.2
1950.......	—	—	—	105.7	129.1
1951.......	—	—	—	109.6	134.2
1952.......	—	—	—	115.6	142.3
1953.......	104.7	—	—	121.6	150.0
1954.......	—	—	—	130.0	161.5
1955.......	—	139.7	153.8	133.1	165.4

SOURCES: U.K.: 1870-1912: Phelps Brown and Handfield-Jones, "The Climacteric of the 1890's", *Oxford Economic Papers,* October, 1952, Table IV, Col. 13.
1924-38: Phelps Brown and Weber, "Accumulation, Productivity and Distribution in the British Economy, 1870-1938", *Economic Journal,* June, 1953, Table III.
1938-53: Philip Redfern, "Net Investment in Fixed Assets in United Kingdom, 1938-1953", *Journal of the Royal Statistical Society,* 1955, p. 158, Table 7 (omitting housing and social services) and C.S.O.: *Annual Abstract, 1955,* Table 129.
U.S.: Simon Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870", Table 11. Extrapolated to 1950 on basis of Goldsmith, *Study of Savings,* Vol. III and Machinery and Allied Products Institute, *Capital Goods Review,* Number 23.
Canada: 1926-45: Chapter 6, Appendix B, Table 6B. 7, 8002A.
1945-55: Chapter 6, Appendix B, Table 6B. 2, 8000.
Labour data from Chapter 5

This retardation of the rate of increase in capital per worker until the recent postwar period is observable in both Canadian and American statistics. Indeed, Daniel Creamer, whose work we mention in Chapter 6, finds no increase in capital per worker from 1929 to 1948 (although later data would suggest that in American manufacturing there has been a pronounced increase since 1948). The Machinery and Allied Products Institute compilations for American industry as a whole confirm Creamer's finding of a decline in the ratio of plant and equipment to labour force since 1929; but they also show evidence of an impressive increase in the ratio since 1946.[10] Such evidence of stagnation in the ratio of capital per worker in the depression and war periods suggests the magnitude of the excess capacity which was built up by industry in both countries in the late 1920's, and which apparently required approximately 15 years to absorb into productive use. Such cyclical fluctuations, however, should not be allowed to obscure the evident strong tendency in all three countries to equip labour with a greater amount of capital, a tendency reinforced by the declining hours of work of the labour force.

Out of this jungle of evidence about saving, lending, capital formation and capital stock we wish to focus attention on two propositions. The first of these is that the proportion of the G.N.E. devoted to capital formation does not display any appreciable long-term change. Differences among countries are important but over the long run in any particular country we observe a marked constancy in the saving-output ratio. The second is that there is a similar constancy in the capital-output ratio. We shall argue in Chapter 3 that this latter constancy is, indeed, a consequence of the former.

4. *Resources and Energy*

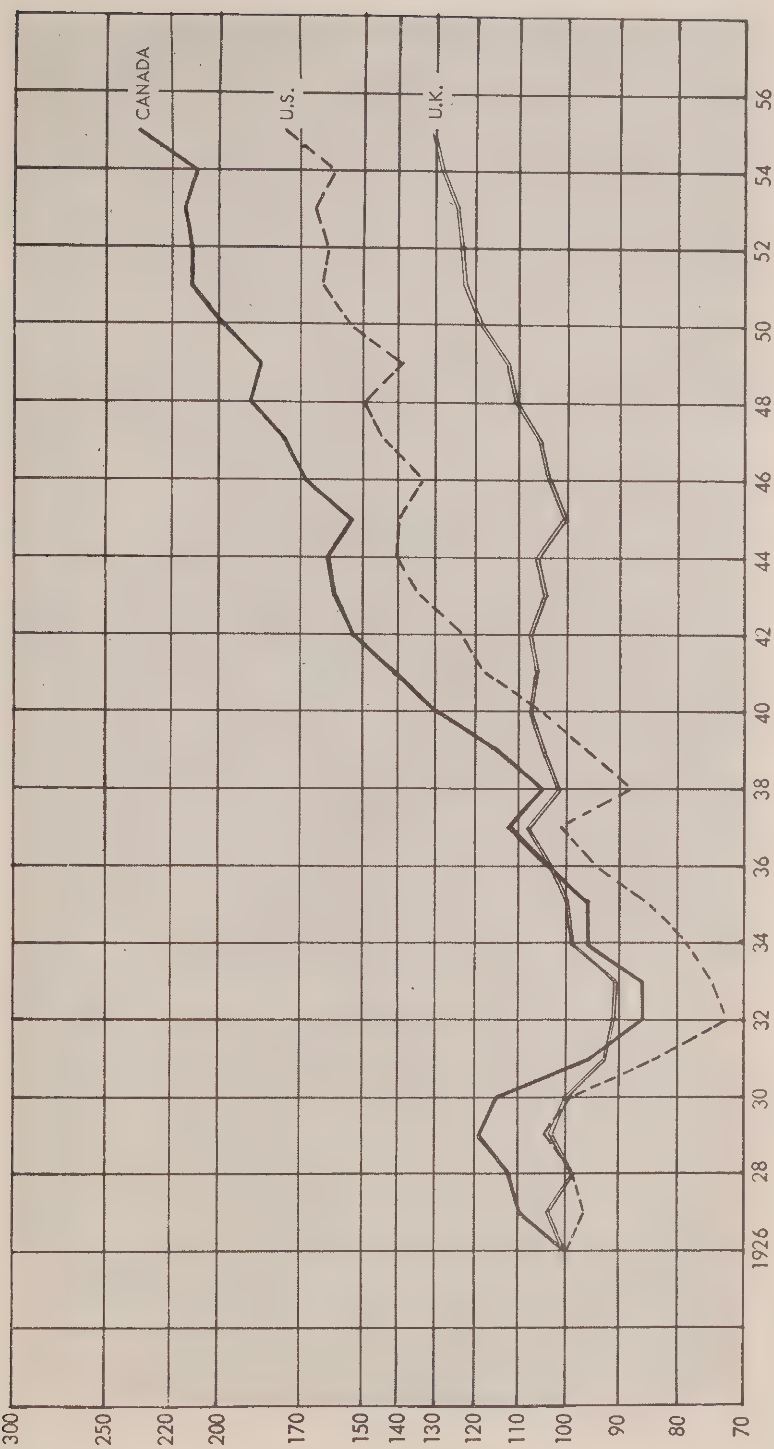
In our review of the growing economy we have examined most intensively the inputs labour and capital. Classical economic theory would suggest that a third input, land, should be considered at this point. Indeed, the school of thought initiated by Thomas Malthus would argue that the most important aspect of economic growth is the relation between the growth of demand and the ability of land to supply the things that are demanded. Malthus suggested that in a growing economy the growth of output would be slowed by the diminishing additional returns yielded by a fixed area of land and concluded that in the absence of restraint on the demand side such as emigration or diminishing natural increase, declining output per head was inevitable.

It is true there are in the world today many so-called Malthusian communities where the increase in demand arising from population growth seems to be more rapid and more intensive than the increase in the productive

[10] *Capital Goods Review No. 23*

Chart 2:13

GROSS ENERGY CONSUMPTION 1926 – 1955
MILLIONS OF TONS OF COAL EQUIVALENT,
INDEX 1926 = 100



power of agriculture and of industry. But in other economies the price and profit system appear to have created incentives leading to new resource discoveries, new methods and the development of new lands which have increased the "resource base" more rapidly than population has increased. Indeed, the upward trends in our estimates of output per man-hour in all the three economies we are examining suggest that increasing scarcities of particular resources have been more than offset. Scarcities of particular resources have met a twofold response: on the one hand exploration for and investment in new resource locations or types, and on the other hand invention and ingenuity in devising more economical processes for using, and substituting more plentiful materials and energy for, those that are becoming scarce. We might go further and suggest that the process of responding to these imminent scarcities has provided a dynamic incentive for most of the change, mobility and risk taking that have typified Canadian economic growth.

It is not the actual disappearance of materials and energy sources, but (as Malthus and Ricardo pointed out) the increasing need for intensively exploiting the best sources and bringing into use the poorer sites that causes increasing expense and what economists call scarcity. An example of increasing demand for a resource, the result both of rising population and rising output per head, is shown in Chart 2. 13 where it is seen that the annual energy consumption of Canada has increased almost 2½ times since 1926 (and rather less in the other two economies). This increased demand has, of course, provided the incentive for enormous investment in the power industries, as we show in Chapter 6. Indeed, power, especially hydro-electric power, has been relatively less expensive in Canada than in other countries, and the development of new sources and of new uses has actually led to the perceptible increase in consumption per capita shown in Table 2. 19 (the increase in the other two economies has been even more gradual). But

Table 2. 19

PER CAPITA ENERGY CONSUMPTION, SELECTED YEARS, 1926-55

(tons of coal equivalent)

	United Kingdom	Canada	United States
1926	4.4	4.9	7.1
1929	4.6	5.4	7.2
1931	4.1	4.2	5.6
1934	4.3	4.1	5.2
1937	4.7	4.6	6.5
1939	4.5	4.6	6.1
1943	4.4	6.1	8.2
1947	4.5	6.3	8.4
1951	5.0	6.8	8.8
1955	5.3	7.0	9.0

SOURCE: *Canadian Energy Prospects*, a study prepared for the Commission.

energy cost has continued to increase, and a strong incentive to economize in the use of energy has appeared. Thus, the three economies have increased their real national products (as shown earlier in Chart 2. 2) with a steadily *falling* use of power per unit of output, as is shown in Chart 2. 14. (Much of this economy in use has depended on improving old methods involving the utilization of coal; since Canada used relatively less coal than the other countries in 1926, she has had less scope for rapid improvement.) The rising cost of power has also created a market for new sources of energy which has spurred the development of petroleum and natural gas, and has produced innovation in the use of atomic, nuclear and even solar energy.

Generally similar adaptation processes can be observed in other resource fields; these are discussed in the Commission's materials and energy studies, in the United States' Paley Report (Washington, 1951, Volume I) and in various studies of wood and paper, fish, minerals, water, iron and, outstandingly, of the agricultural complex of soils, markets, transport and mechanization. In each case, rising prices precede exploration, investment, economizing and substitution.

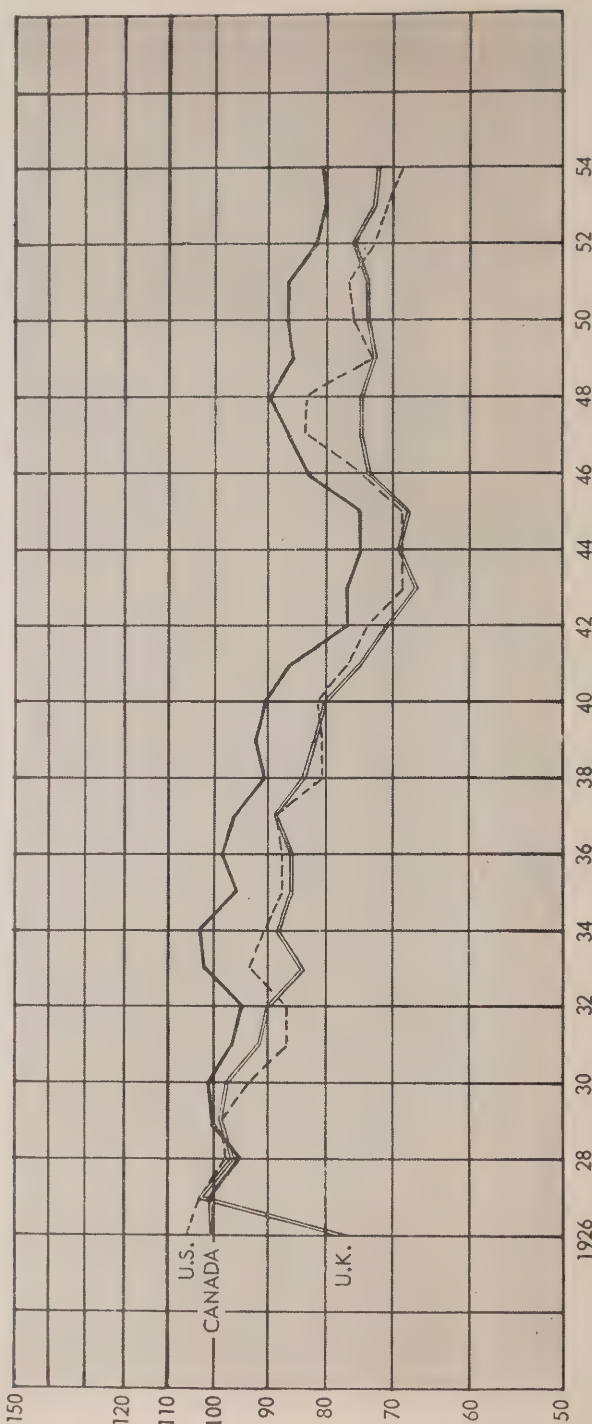
The substitution process involves more than the eventual replacement of one raw material by another. Since natural resources are, from the point of view of the economy, simply a natural form of capital, they may be substituted for man-made capital goods, and vice versa. Competition between rivers and canals provides an obvious example in the transportation field; less obvious is the functional similarity of, say, forests and machinery. In forestry man exploits, maintains or depletes his sylvan capital just as in a factory he exploits, maintains or depreciates his equipment. The royalty on forest resources provides the finance for new investment just as amortization quotas on machines may provide funds for new investment. Forests, like mines, fields and fisheries, are governed by the same economic considerations as capital goods, and to adopt a special attitude toward their use, disappearance or renewal would be misleading. Economic growth has certainly been characterized by the conversion of much of the original *natural* capital into more useful types of capital goods, and into consumption goods. But there have also been extraordinary efforts to improve and sustain the operation of especially valuable natural resources by concentrating on the problem the results of research, the facilities of better transportation, and the economies of careful and sparing utilization

This process may either hinder or help the economic growth of particular nations. The United Kingdom provides an obvious example of increasing shortage (in this case, of coal) leading to the use of relatively expensive imported substitutes, and perhaps to the loss of advantage in the export markets. The difficulties of the Canadian Maritime Provinces might also be cited as an illustration. On the other hand, the central provinces and British

Chart 2:14

ENERGY CONSUMPTION PER UNIT OF REAL NATIONAL PRODUCT 1926 — 54

Index Numbers: 1926 — 30 = 100



Columbia have benefited from the world-market scarcity of energy, wood, and many minerals; on the whole, Canada with its many resources stands to gain rather than lose from the efforts of the world economy to adapt itself to the shortage of energy and material sources. A question that poses itself is whether the natural capital with which a country has been endowed will be converted by the economic system into capital goods which will equip workers in the same region, or whether the succeeding capital goods will be installed elsewhere. If the latter takes place, workers may have to emigrate to avoid a declining level of income or employment.

Questions such as this, important as they are for an understanding of economic growth, are difficult to state in precise, let alone quantitative, terms. A complete study of the growth of a particular economy must review not only changes in the aggregate of resources, the adaptability of each resource for evolving uses, and the availability of substitutes and transportation facilities, but also changes in the stocks of capital goods that are substitutes and complements for resources. Further, since the depletion of resources may be more than offset by the accumulation of goods, methods and ideas, analysis requires balancing in some way the changes in one aggregate against changes in the other, to obtain an idea of the net change in the aggregate productive capacity. Neither data nor conceptual tools are yet available for this task.

5. *The Distribution of Income between Labour and Other Factors of Production*

Our emphasis so far has been upon changing rates of output and input during economic growth. We have noted a pattern of change in the proportions among inputs, in particular an unmistakable tendency for the capital-labour ratio to rise. Now the national income earned in the production of the national output is paid for the services of the factors of production. We wish next to ask to what extent the division of the national income among the factors reflects the changing proportions in which these factors are employed as inputs.

Some writers of an earlier day raised this question to a central place in their ideas of growth. Ricardo and Malthus, for example, believed that as a capitalist economy grows, changes in the distribution of income would result in a "tendency of profits to a minimum". Marx, using the same tools of analysis, wrote of the ultimate appropriation by capital of the whole of "surplus value". Later writers inclined to the view that technical change, resource discoveries and other innovations tended to disturb the supposedly irresistible tendencies in income distribution anticipated by these earlier classical writers. And as better statistics became available, including those derived from income tax returns, accumulated evidence seemed to indicate

that the relative share of wage earners in the national income remained remarkably constant over time. Keynes, noting the stability of the proportion of the national income accruing to labour, called it "one of the most surprising, yet best-established, facts in the whole range of economic statistics, both for Great Britain and for the United States". Indeed, he thought that this stability was a "bit of a miracle".[11]

In what follows, we shall concern ourselves with two specific, but very intimately related, questions: first, does the share of labour in the national income change persistently in any one direction as the economy grows, and second, does the rate of return to capital change persistently in any direction as the economy grows. To answer the first question we must investigate the ratio of labour earnings to national income; to answer the second we must study the ratio of property income to the stock of capital.

The attempt to measure the share of the national output going to the suppliers of a particular factor of production is impeded by difficulties of classifying the incomes arising in some of the more important sectors of the economy. For example, the labour forces engaged in agriculture, mining, services and trades, include many individuals who are at one and the same time owner, landlord, manager and workman. Neither they nor statisticians are able to decide what portion of their incomes should be classified as "wages". The larger the proportionate size of such industries in the whole economy, the more difficult is the task of deciding just what is the share of labour in the national income. Only in some types of manufacturing and in the type of agriculture common in Britain and France in the eighteenth and nineteenth centuries will we find labourers employed by a different group of people called managers, all financed by a third group called capitalists who in turn rent land from landlords. Such a simple pattern would make it convenient to sort out the national income into factor rewards but, unfortunately for this purpose, it is not the pattern which we see in the Canadian, British or American economies today. Furthermore, a large part of the contemporary national product emanates from government and from government enterprises where the concepts of the return on capital and land and, *a fortiori*, the reward for risk taking and enterprise are hardly applicable. Therefore we must restrict the analysis to a radically simplified division of the national product between "labour" income and a residue which may be thought of as "property" or "capital" income.

In Table 2. 20 we show some estimates of the percentage of the national income of the three economies that is distributed as wages and salaries. The reader should be warned that the percentages are not altogether comparable between countries because of the differences in classifications used. The estimates do suggest, however, that there is some warrant for the belief that

[11]J. M. Keynes, "Relative Movements of Real Wages and Output", *Economic Journal*, XLIX, March, 1939, pp. 48-49.

there is a "miraculous" constancy within each country in the share of labour in the national income.

The statistical difficulties for Canada are especially great in the period since 1951, since it is believed that the data for wages, salaries and supplementary labour income, as published in the national accounts, may understate somewhat the actual amounts of such payments. Therefore, the table which for Canada must already be qualified by the uncertainty of the method of dealing with agriculture since 1950 (see notes to the table) is further in need of qualification. It is possible that the recent proportions shown in the table would be appreciably higher, perhaps by two or three percentage points, if a revision of the wage data were made.

Table 2. 20

THE PERCENTAGE SHARE OF WAGES AND SALARIES IN THE NATIONAL INCOME

	United Kingdom Wages and salaries	United States Service income	Canada Wages, salaries, etc.
1871	54	—	
1875c	—	76.5	
1881	54	—	
1885c	—	75.4	
1891	60	—	
1895c	—	77.7	
1901	60	—	
1905c	—	75.8	
1911c	56	82.9	
1924c	66	81.2	
1926	—	—	78.1
1929c	64	79.7	78.3
1931	69	—	84.1
1935c	—	80.8	68.3
1941	59	—	68.4
1945c	—	88.0	65.1
1950	64	—	70.3
1951	—	—	68.8
1952	—	—	70.6e
1953	—	—	73.6e
1954	—	—	76.1e
1955	—	—	72.9e

c Centre year of overlapping decades for U.S. data.

e Agricultural labour return estimated by extrapolation of 1951.

SOURCES: U.K.: Phelps Brown and Hart, "Share of Wages in the National Income", *Economic Journal*, LXII, June, 1952, pages 276-277. Estimate here consists of wages plus salaries divided by net home-produced national income.

U.S.: Simon Kuznets, *Income and Wealth of the United States, Trends and Structure;* Income and Wealth, Series II, Cambridge, England, 1952, p. 136. Estimate here is employee compensation plus entrepreneurial income divided by "aggregate payments" (net national product at factor cost less corporate and government savings).

Canada: National accounts' "wages, salaries and supplementary labour incomes" plus income from non-farm unincorporated business times .68 (estimated ratio for 1950) plus an estimate of the labour return portion of agricultural income all divided by national accounts' net national income at factor cost. From 1929 to 1940 the labour return is presumed to have exhausted agricultural income.

An examination of the table suggests that the percentage share of wages and salaries, although fluctuating, fluctuates within fairly narrow limits. It is probable that the fluctuation is the consequence of three different sorts of changes in the national income. First, in a serious depression profits fall and might conceivably disappear, whilst the share of labour in a diminished income rises. Second, the share of wages depends upon output per worker which itself depends partly on the size of the labour force, its skill, the efficiency of capital and the nature of new inventions. We have already referred to the hypothesis advanced by some writers that over the course of economic history periods in which the predominant form of innovation is capital-using alternate with periods in which innovators are commonly less capital-using. Capital-using innovations tend to make capital relatively scarce and thus to raise its return and perhaps its share. Capital-saving innovations would be likely to have the opposite effect.[12] Third, the share of labour in the national income may be affected by occupational shifts. By this we have in mind the change in the proportion of output emanating from particular industries which may have either pronouncedly capital-saving or capital-using processes. For example, if the composition of total demand for services were to change so that a large number of members of the labour force moved from transportation into health, education and government services, the demand for capital relative to the demand for labour would probably decline so that the share of labour in the national income (given certain technical assumptions about the productivity curves of capital and labour) would probably increase.

In a recent publication, Harold M. Levinson has attempted to remove the effect of such shifts in the industrial composition of the national output, and so to obtain a "corrected" measurement of the share of labour in national income. His results, shown in Table 2. 21, suggest a quite remarkable fixity in labour's percentage share. This result in turn suggests that an alteration in particular industries' shares in the national output may be the method of carrying out a change in the industrial technique of the whole economy. If so, the third effect of the three listed above may be merely a symptom of the second force at work, and it would be inappropriate for us to "correct" our data for the changing industrial division of national output until more evidence is available on how innovation makes its impact and is gradually applied throughout the changing economy.

We shall not, therefore, divert this examination of the manifestations of economic growth into further analysis of what is clearly a very complicated theoretical and statistical problem. We can only report that the evidence of the tables suggests to us an impressive constancy in the ratio between wages and the national income. While the ratio fluctuates with the

[12]For an analysis the reader is referred to William Fellner, *Trends and Cycles in Economic Activity*, New York, 1955.

business cycle and, indeed, seems to rise and fall slowly with the waves of technical and demand change, there is nevertheless evidence that over a long period of time, and in spite of rapid growth, forces either fortuitous or systematic have kept the ratio within fairly narrow limits. Although these limits have differed in the three economies examined, the proposition appears to hold for each of them individually. We shall refer to this constant ratio in Chapter 3.

Table 2. 21

U.S. PERCENTAGE SHARE OF EMPLOYEE COMPENSATION IN PRIVATE NATIONAL INCOME, 1919-47

(corrected for changes in the relative importance of different industries)

1919	55.4	1933	77.5
1921	58.8	1937	61.7
1923	58.8		
1925	57.9	1941	56.6
1927	59.7	1945	58.1
1929	58.9	1947	58.5

SOURCE: Harold M. Levinson, *Unionism, Wage Treads, and Income Distribution, 1914-1947*, Ann Arbor 1951, Tables 17 and 23. The weighting of the industries changes in 1929.

Let us turn now to the ratio of property income to the stock of capital. Useful statistical evidence on this ratio, which may be loosely referred to as the rate of return on capital, is even more scarce than that on the share of wages. We are interested in the course of the percentage relationship between property income and the cost of new capital goods (and developed land) which are the source of this income. Instead, we have only data on yields of a variety of corporate securities and yields of government securities. Rarely have we estimates of the rate of return on the volume of physical capital.

In Table 2. 22 we show Simon Kuznets' *indicators* of the rate of return on total capital in the United States, measured in percentage terms. These, it appears, declined during the nineteenth century, then increased very slightly, and finally since the beginning of the depression of the 1930's declined drastically. (It is not impossible that up-to-date estimates would indicate a rise since 1947 or 1948.) These fluctuations in the yield of capital are found both in Kuznet's own calculations on the yield on real capital (column 1) and in the series on corporate bond yields (column 2). The latter series is rather more unstable than the former. If the share of property in output remains constant, one would expect that an increase in the ratio of capital to output would be simultaneous with a decrease in the ratio of property income to capital. Since the share of property *has* fluctuated around a constant level, we should look for an inverse correlation between the rate of return on capital and the capital-output ratio: that is, for a decline from the late nineteenth century to about 1920, and an increase since.

Table 2. 22

U.S.: RETURN ON CAPITAL, 1879-1949

	Percent yield on total capital (Kuznets)	Bond yields (Macaulay and Durand)
Decade beginning		
1879	3.9	5.4
1889	3.9	4.0
1899	3.2	3.5
1909	3.3	3.8
1919	3.0	4.6
Quinquennium beginning		
1924	3.3	4.7
1929	3.3	4.5
1934	3.1	4.0
1939	3.1	3.1
1944	2.4	2.7

Column 1. Percent share of property income/Ratio of capital to N.N.P. (i.e. Profit + interest/Capital).
Column 2. 1879-1936: Macaulay: top grade railroad bonds.
1936-1949: Durand: basic corporate bonds.

SOURCE: Simon Kuznets "Long-Term Changes in the National Income of the United States of America since 1870", *Income and Wealth of the United States, Trends and Structure;* Income and Wealth, Series II, Cambridge, 1952, Table 13.

We must admit that the series in Table 2. 22 do not convey this impression. True, they do fall, as expected, from the late nineteenth century to about 1910. But the subsequent increase is broken off with the Great Depression, and the series drifts down to a new low. Either our hypothesis about interconnection is wrong or the data are inappropriate.

There is no doubt that the data leave a great deal to be desired. During the period 1929-48 the excess capacity of unprecedented depression reduced yields abnormally, to say the least; and the relatively high wages and the low bond rates of wartime (kept low by financial policy) prevented dividends and interest from rising much faster than the total stock of capital. Only the increase after World War I should be accepted as indicative of the long-run trend.

Corporate bond-yield data too are riddled with difficulties of interpretation. Bond yields are after all merely the return on a particular type of indebtedness, an instrument that is in competition with other kinds of claim for investors' funds. Changes in yield reflect not only changes in the rate of return on capital—and that with a lag—but also changes in the attractiveness to lenders of other instruments such as preferred shares, common shares, government debt, promissory notes and mortgages. Further, the relative attractiveness of the various types of instrument is affected by tax rates and regulations, price level trends, monetary policy and the general business climate. Hence, though gilt-edged bond yields might seem at first sight to

indicate the course of risk-free rates of return on capital, fluctuations in their statistics may be quite independent of fluctuations in the real rate. We must, therefore, also consult evidence on business earnings and on business dividends. Here we are at once up against the difficulty that corporations do not necessarily distribute their earnings and, further, that even if they did, our historical record would be greatly affected by changing rates of corporation income tax.

Furthermore, even if one were able to allow for the effect of taxes on earnings, one would still have the difficulty of allowing for changes in the relative desirability of stocks and bonds in the financial markets. At one time, before the present prevalence of the modern large corporation, borrowing through the issue of bonds, mortgages and other evidence of fixed indebtedness was the prevalent method of securing external finance. Today, however, the common share and the preferred share are highly favoured methods of financing, the desirability of which, however, changes with the composition of the market; that is, with changes in the relative importance of individual purchasers, insurance companies, trust companies and banks, and pension and investment funds as suppliers of finance or savings. Some types of institutions conventionally or by law do not provide a market for certain types of securities. Changes in the composition of the market, therefore, are likely to bring about changes in the rate of return on certain types of securities which do not reflect underlying changes in the rate of return on real capital. Furthermore, the rate of return on stock reflects not only the current yield but also the market's expectation of what the yield and future market price will be, though, of course, it is to be hoped that stock purchasers are not perpetually wrong and disappointed in their expectations.

Evidence provided by the rather definite nature of the Kuznets bond-yield decline in the above table is contradicted by other evidence which shows apparently fluctuating trends in the rate of return on other types of security. Some of this other evidence is shown in Table 2. 23. (The reader will notice the sparsity of Canadian data; we have been forced to utilize chiefly American information.) The table suggests that while the figures move within fairly narrow limits in that, for example, they never rise above 9%, there appears to be great year-to-year instability, especially in the early twentieth century. We would suggest that over the last 70 or 100 years there has been a slight decline in bond yields but that there is very little evidence of any long trend in the yield on common shares. Furthermore, the earnings per share (including both dividend and retained earnings) may even have increased; if this is so, it would provide an offsetting factor to the decline in bond yields.

Table 2. 23

MARKET INDICATORS OF THE RATE OF RETURN ON CAPITAL SINCE 1870: U.S. AND CANADA

(percentage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	United States							Canada	
	Commercial and customer bank loan rates, total leading cities	Basic yields of corporate bonds — 50 years to maturity	U.S. government bond yields: long term; partially tax exempt	Common Stocks (Cowles — all types)	Common Stocks (Moody's — all types)	Earnings per share/Price per share; Industrials (Moody's)	Preferred stocks (Standard & Poor's high-grade)	Government of Canada theoretical — 15-year bond yields	Index of long-term bond yields — 1935-39=100
1871	—	—	—	5.3					
1876	—	—	—	7.0					
1881	—	—	—	4.8					
1886	—	—	—	3.8					
1891	—	—	—	4.3					
1896	—	—	—	4.1					
1900	—	3.3	—	4.3					
1901	—	3.2	—	3.8					
1906	—	3.6	—	3.8					
1909	—	3.8	—	4.3					
1910	—	3.8	—	4.8					
1911	—	3.9	—	4.9					
1913	—	4.0	—	5.4					
1914	—	4.1	—	5.0					
1919	5.7	4.7	4.73	5.8	—	—	6.3		
1920	6.6	5.1	5.3	6.1	—	—	6.8		
1921	6.7	5.2	5.1	6.5	—	—	6.8		
1923	5.5	4.6	4.4	5.9	—	—	6.1		
1926	5.1[a]	4.4	3.7	5.3	—	—	5.8	—	139.0
1929	6.0	4.4	3.6	3.5	3.4	6.1	5.1	—	141.3
1930	4.8	4.4	3.3	4.3	4.5	4.5	5.0	—	135.4
1931	4.3	4.1	3.3	5.6	6.2	2.8	5.0	—	132.5
1936	2.7	3.3	2.6	4.4	3.5	5.8	4.3	3.0	98.1
1939	2.8	2.8	2.4	—	4.2	6.3	4.2	3.2	101.8

Table 2. 23 (Cont'd.)

MARKET INDICATORS OF THE RATE OF RETURN ON CAPITAL SINCE 1870: U.S. AND CANADA

1941	2.5	2.6	2.0	—	6.3	10.2	4.1	3.1	100.6
1945	2.4	2.6	1.7	—	4.2	6.2	3.7	2.9	95.1
1947	2.1[a]	2.6	2.3[a]	—	5.1	11.8	3.8	2.6	84.4
1949	2.7	2.8	2.3	—	6.6	14.2	4.0	2.8	93.0
1952	3.5	3.1	2.7	—	5.5	9.4	4.1	3.6	116.2
1954	3.6	3.4[a]	2.6	—	4.8	8.7	4.0	3.1	101.7
1955									

a Change in series.

SOURCES: Col. 1: *Historical Statistics of the United States*, Series N 188 and 188a.
Col. 2: *Ibid.*, Series N 200.
Col. 3: *Ibid.*, Series N 203.
Col. 4: *Ibid.*, Series N 206.
Col. 5, 6, 7: *Survey of Current Business Statistics Supplement 1955*, p. 100.
Col. 8: Bank of Canada Statistical Supplement, various years.
Col. 9: *Canadian Statistical Review Supplement 1955*, Table 67.

It seems, therefore, that the evidence does not strongly suggest any long-run rise or decline in the rate of return on capital; indeed, it is compatible with an assertion that the rate of return on capital in the long run is constant. But we must reiterate that the rate of return on bonds is a poor indicator of the underlying profitability of capital owing to both the generalized inflation which has impinged more heavily on bond than upon share incomes and to the arbitrary fixing of interest rates by governments during war and postwar periods. The alternative data on earnings and dividends are too unstable to present any very clear picture of long-run change. We may therefore as a last resort attempt to deduce from evidence given earlier the probable course of the rate of return on all capital over the long run. We begin with some theoretical propositions:

(a) We have more or less established that in the long run the share of wages in the national income may be regarded as constant.

(b) We assume, for the sake of argument, that the residue of the national output is returned to capital.

From these we deduce that the share of capital in the national income must also be constant.

(c) We have argued that the capital-output ratio is approximately constant over time.

Therefore, the rate of return on capital must also be constant over time. Alternatively, if the capital-output ratio is changing, the rate of return on capital must be changing in the opposite direction.

6. *Regional and International Aspects of Growth*

In this synopsis of the statistical record of economic growth we have thus far referred in particular to changes in output, labour and capital, ratios among these variables, the rates of return to labour and to capital and the shares of output accruing to these factors. We have also referred to the distribution of national expenditure as between consumption on the one hand and saving or investment on the other. We wish now to consider changes in the spatial or regional distribution of income and output, and their association with economic growth.

One aspect of the regional impact of economic growth that is a matter of common observation is urbanization, with its concomitant depopulating of the countryside. It is difficult, however, to assert that urbanization is *necessarily* connected with economic growth. Certainly less rapidly growing economies than Canada have experienced a greater exodus from the farm, while on the other hand, in earlier periods Canadian economic growth has been dominated by the populating of the countryside, in the sense of

pushing back the frontier of settlement. There can be no denying however that rapid urbanization is a feature of economic growth in North America today and in many other areas as well. Advances in science and engineering that have solved problems of supplying, transporting and maintaining the health of dense pockets of population have been permissive factors in this development, as geographers and other students explain. But the root causes lie in the increasing preferences of the population for the products of the factories, for the amenities of city life as opposed to country life, and in rising incomes. Though we must resist the temptation to discuss these matters here, some discussion as well as statistical evidence on the extent and dimensions of urbanization may be found in the Commission's study of *Housing and Social Capital.*

Table 2. 24 gives a brief synopsis of the changing degree of urbanization in Canada in recent years.

Table 2. 24

GROWTH OF METROPOLITAN AND OTHER URBAN AREAS

(percentage of total Canadian population)

	1921	1941	1951
14 metropolitan areas	31	35[b]	38[b]
20 other leading urban areas (over 40,000 in 1941)	7	8	9
All other areas, urban, rural and rural non-farm	62	56	53
All Canada[a]	100	100	100

a Excludes Newfoundland, Yukon and Northwest Territories.
b These metropolitan areas are comparable with those of 1921; they are not, in all cases, those shown in recent census definitions.
SOURCE: Study for the Commission, *Housing and Social Capital,* Chapter 2.

The most striking evidence here is the loss of the "all other area" category since 1921 (the absolute figures move from 5.5 million to 7.2 million), and the amazing gain of the metropolitan areas (the absolute figures nearly double, going from 2.7 million to 5.2 million). The authors of the social capital study expect this movement to continue until 1980, when 45% of the Canadian population will be found in the metropolitan areas.

The metropolitan areas are not scattered uniformly around the economy —most of the metropolitan urban population of Canada is to be found in the industrial central provinces, while the Prairies and the Maritimes are chiefly rural. Let us look now at the regional distribution in Table 2. 25.

The loss of Prairie (especially rural) population is particularly clear; in some years the population of the Prairies has fallen absolutely, though not

from census year to census year. The Atlantic (or Maritime) provinces have also lost ground, while the central provinces and British Columbia have gained more rapidly than the country as a whole. Part of this change is due to changing birth and death rates within each region, and part to differences in these rates among regions. Another cause, of course, is the movement of population from one region to another. We lack data on this movement—the very fact that it is movement within Canadian borders means that no statistical agency is informed of individual decisions to move.

Table 2. 25

POPULATION OF CANADA BY REGION

(percentage of total Canadian population)

	1921	1941	1951
Atlantic[a]	14.0	12.2	11.6
Quebec	26.1	28.3	29.0
Ontario	32.5	32.1	32.9
Prairies	21.6	20.5	18.1
British Columbia	5.8	6.9	8.3
All Canada	100.0	100.0	100.0

a Maritimes prior to 1951.
SOURCE: Chapter 4, Table 4. 17.

The rough estimates of Table 2. 26, however, are indicative of the size of the impact that movement has had on each region. It can be seen that the Province of Quebec has been relatively undisturbed by movements of people to or from other regions. But among the other regions, there have been disturbing changes: the early tendency of people in the Maritimes to move west has been recently matched by Prairie emigration, while from 1941 to 1951 every 100 persons living in British Columbia in 1941 had been joined by fully 28 immigrants from eastern regions.

Table 2. 26

CANADA: PERCENTAGE OF 1941 POPULATION GAINED OR LOST BY EACH REGION FROM INTERPROVINCIAL MIGRATION, 1931-51

	1931-41	1941-51
Maritimes	—0.5	—8.2
Quebec	—0.1[a]	—0.1[a]
Ontario	2.0	8.0
Prairies	—10.2	—12.0
British Columbia, Yukon and Northwest Territories	10.0	28.2

a Less than 0.1%.
SOURCE: *Canada Year Book, 1955*, p. 137, Tables 2 and 3.

For persons living in any one of these regions economic growth might well be identified with their success in holding and attracting population; those in regions that have lost population absolutely or relatively may feel

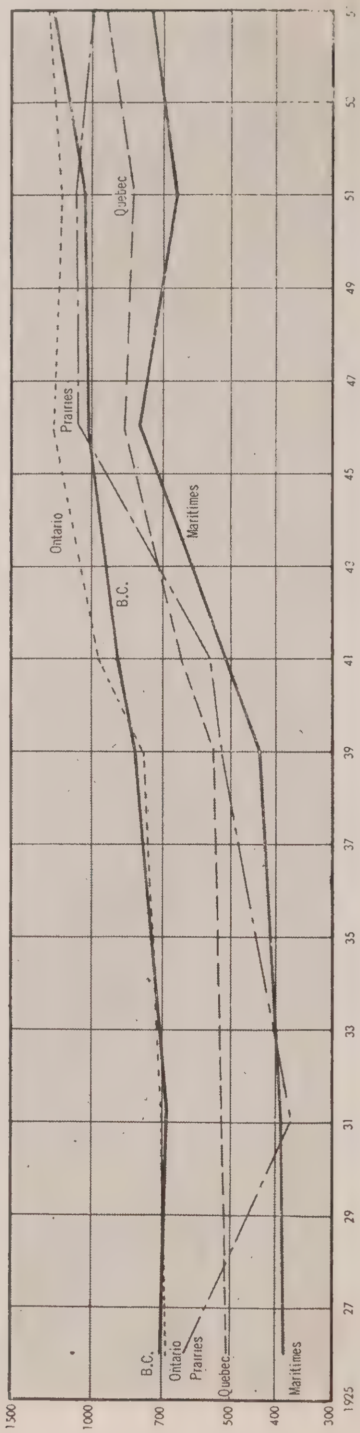
that economic growth is eluding them. Further light on regional economic growth, however, would be shed by evidence on the growth of income per capita in each region. It is well recognized, in Canada at least, that average incomes differ. The regions of the country differ in their natural endowments, their closeness to markets and their transportation facilities. One would expect that labour would be highly paid and incomes relatively high where physical wealth is abundant, if labour is uniformly distributed and immobile. But in fact the location of labour is influenced by economic incentives to move whither productivity is high, so that the more mobile labour is, the more similar will be the marginal productivity of labour, and hence—with some qualifications—wages in physically differing regions.

It would be agreeable to be able to present comparative income data like that discussed at the beginning of this chapter, i.e., adjusted for changes in the price level and inclusive of depreciation and indirect taxes. Instead, we are forced by the absence of such data to report *personal* income figures by region, adjusted only for changes in the cost of living index. Such estimates tend to understate the level and perhaps the growth of output of regions remote from head offices of national corporations, with regional establishments and to omit entirely the effect of many types of government service-providing programmes. This evidence is shown in Table 2. 27 and Chart 2. 15. In order to make some allowance for the different size of the regions, the data are divided by the populations and so shown per capita.

Clearly, there are large and persisting deviations from the average Canadian level of personal income per capita. Ontario is pronouncedly richer than other regions, and British Columbia, the Prairies, Quebec and the Maritimes follow in that order. But what of the rates of growth? Are personal incomes per capita in low-level regions growing more slowly or less slowly than in the Canadian economy as a whole? As a first approximation, we may answer that the rates of growth are strikingly more similar than the levels; although the mobility of persons and industries is evidently not sufficient to bring the levels together, there may be forces at work to keep the rates of growth of the levels similar to one another. Thus, since 1926 real income per capita in the Maritimes has approximately doubled; this is true also for Ontario although these two regions are at opposite extremes of the scale of personal incomes per capita. Slightly lower rates of growth have been experienced by Quebec and British Columbia, with the Prairies in this case showing the lowest rate of growth over the whole period, after exhibiting a rapid rate in the period up to 1946. In view of the re-allocation problems implied by change in farm enterprise and farm size, it is not surprising that the growth in personal income in the Prairies has been less than that elsewhere in Canada.

Chart 2.15

PERSONAL INCOME PER CAPITA
1949 PRICES



Source: Table 2.27

Table 2. 27

REAL PERSONAL INCOME BY REGION

(1949 dollars)

	Atlantic		Maritimes		Quebec		Ontario		Prairies		British Columbia (with Yukon and N.W.T.)	
	millions	per capita	millions	per capita	millions	per capita	millions	per capita	millions	per capita	millions	per capita
1926.....	—	—	380	381	1,320	507	2,155	681	1,306	632	438	708
1931.....	—	—	386	383	1,497	521	2,402	700	875	372	494	699
1939.....	—	—	477	433	1,758	544	2,867	773	1,274	527	615	759
1941.....	—	—	574	508	2,144	643	3,666	968	1,343	554	740	885
1946.....	—	—	937	794	3,073	847	4,918	1,201	2,377	1,006	1,165	1,005
1951.....	998	617	819	652	3,289	811	5,303	1,153	2,731	1,072	1,323	1,025
1955.....	1,233	700	1,000	741	4,202	930	6,673	1,287	2,819	999	1,699	1,266

SOURCE: *Some Regional Aspects of Canada's Economic Development*, a study prepared for the Commission. Personal incomes by region (as in National Accounts) divided by cost of living index. Atlantic region includes, Maritimes excludes, Newfoundland.

A comparison of Tables 2. 26 and 2. 27 shows that in the main people have shifted from places with low or slowly growing incomes per capita to regions with high and rapidly growing incomes. Insofar as people move in response to economic incentives it may be argued that high incomes attract persons from regions with lower incomes. But, as with urbanization, regional population shifts cannot be explained solely in terms of economic incentives. Moreover, the shifts, whatever their causes, have secondary economic effects. To the receiving regions, new arrivals bring education, ability and capital, and their very arrival creates new demands, increased output and increased income. The shifts may result in less well educated or less enterprising people being left in the lower income areas; but on the other hand they may relieve population pressure in the low income regions and contribute to the rise in income there.

Thus, there is a confusing complexity of interacting forces governing the relationship between the rates of growth of regions within Canada. What is cause and what is effect cannot easily be settled; a regional examination of growth requires research into attitudes, resources, discoveries, transportation costs, technical changes and shifts in demand. These matters are taken up in the Commission's study of *Some Regional Aspects of Canada's Economic Development.*

We have seen that although each region has its own rate of growth of income per head and of population, over the long run the figures of income per capita do not display striking divergencies in their rates of growth. The poorest and the richest regions, in particular, appear to have progressed uniformly. We believe it very probable that the uniformity of growth as between these regions is encouraged by the close contacts between them in trade, communications and population movements. Moreover, we believe that the relative rates of growth of regions within the Canadian economy are amenable to the same analysis as rates of growth among national economies, and still with the object in mind of summarizing manifestations of economic growth among different regions, we turn now to international aspects of our theme.

Already, in our tables and charts and in the accompanying discussion of growth in the three economies that we have examined, we have presented evidence of one of our most important conclusions. This is, that in spite of different resource endowments, populations and capital stocks, the rates of growth of output, output per person, output per hour and capital per head display surprising similarities among the three nations. It is true that the levels of these variables and ratios, if they could be accurately compared, would show significant differences: indeed the differences must in many cases be widening, if the rates of growth are the same. (This was seen also in the regional comparison of personal incomes per head within the Canadian

economy.) Such similarities in rates of growth are not, we believe, accidental. Since these nations have been part of the same larger economic trading area, have shared the same climate of technological development, borrowed and lent in the same markets and permitted inter-migration, it is probable that these contacts between them have acted as bonds that have kept their rates of growth similar. We wish now to examine the record of these contacts, as far as statistical evidence will permit.

Undoubtedly the most important contact is that provided by trade in goods and services—exports and imports. The advantage, or rather the comparative advantage, of each country in producing certain types of exports has changed over time, and with this change has come changing demands for imports. Such changes are intimately connected with the changing importance of domestic industries. In the Canadian case, for example, the agricultural share of total output and of total employment has declined, a reflection of the falling significance of wheat in Canadian exports. American petroleum and British coal exports might also be discussed in these terms. The outcome of these changes may best be summarized by examining the ratio of imports and exports to the national output.

In Canada both of these ratios have fallen since 1926. In Table 2. 15 it was seen that exports, which were about 30% of the G.N.E. in 1926 are today at about 23% (the precise figure depends upon whether the calculation is undertaken in current or in constant prices). Imports have also declined in the same 30-year period. As the economy grows, its ability to manufacture acceptable substitutes for things which were previously imported increases; and its desire to keep for home use things which were previously exported also increases. This is merely an application of Adam Smith's dictum that the division of labour, enhancing the growth of efficient production, depends upon the extent of the market. Thus, we should not be surprised that foreign trade has declined relatively to the national income. Nevertheless, this is not a universal symptom of economic growth. Other countries at other times have achieved economic maturity by increasing their dependence upon international trade.

One factor working toward more trade during economic growth is that development may depend upon the importation of capital goods from other countries. This is apparently true of Canada: the more rapid the growth, the larger the absolute importation of machinery and equipment and structural supplies. Reinforcing this effect is the desire of those with larger incomes to import more luxuries — exotic and specialized products — from other economies. Both tendencies serve to increase the ratio of imports to the G.N.E. Reference to Table 2. 15, showing the distribution of the G.N.E. by expenditure categories, reveals both that the share of imports has been declining over time and also that in times of most rapid growth, i.e. in those

years when Canada has been experiencing a boom, the increase in imports has been dramatic. In other, less expansive, periods, however, Canadian imports have fallen more rapidly than the national income. We are left with the conclusion (to which, it must be admitted, we have here done no more than refer) that no very useful long-run generalization can be made about changes in the ratios of imports and exports to national income during a long period of economic growth in any particular country. (In Chapter 3 we shall discuss briefly a theoretical relation between import-income ratios and rates of growth of income of trading countries, but this proposition will not pertain to the change over time of such ratios in particular countries.) For the short run, scholars have made close analysis of the "marginal propensity to import", but their findings cannot aid us much here.

It is sometimes argued that what is more interesting than the ratios of imports and exports to national income is the experience of a nation in selling its exports as a *quid pro quo* for its imports. The price of the things which Canada sells abroad have increased in sympathy with rising demand and increasing scarcity; so also have the prices of her imports. Which price series has increased more rapidly? The ratio between the two series, which we may call, loosely, "the terms of trade", measures the changing quantity of imports of goods and services that can be purchased with a dollar's worth of Canadian exports. This subject is related to our earlier remarks on price changes in growing economies, since, other things being equal, the terms of trade of each economy reflect in the short run the relation between its home price level and that of its trading partners.

In some countries over a long period the terms of trade have tended continuously in one direction. In the United Kingdom, for example, it has been argued that in the 1930's a pound's worth of British exports could be used to buy many more imported and consumer goods than was the case in the late nineteenth century[13] but that this movement in the terms of trade has been reversed in the last 20 years. This reversal is largely attributable to the increasing world supplies of manufactured goods and to the increasing demand for scarce raw materials, fuels and foods from primary producing countries. Furthermore, it is sometimes argued that the European ownership of sources of raw materials in foreign countries produced in the nineteenth century an artificially low price for the products of colonial economies.

This change in terms of trade has produced a systematic and theoretical view of world economic growth which is allied to that which we discussed earlier in connection with the changing division of the national output between agriculture, manufacturing and services. The view to which we now refer is also held by Mr. Colin Clark; it maintains that the growth of the world economy is accompanied by, on the one hand, an increasing shortage of raw materials and food and, on the other hand, an increasing availability

[13]W. Arthur Lewis, *Economic Survey 1919-1939*, London, 1949, p. 192.

of manufactured goods. Hence, the price of manufactured goods is expected to rise less than the price of raw materials; the international manifestation of this changing price relationship is said to be the declining terms of trade of the European manufacturing economies.

If, however, we examine the Canadian terms of trade we find that the applicability of this generalization to Canada is not clearly demonstrated. The rapid shift of Canadian export concentration from primary products to newer and somewhat more manufactured goods, and to services presents a statistical difficulty, because it means that even for the last 50 years price indexes of exports do not apply to a bundle of goods of given composition. To a lesser degree, the same reservations apply to import price indexes. Consequently, any terms of trade index must be the ratio of two price indexes stretching over a long interval during which neither is homogeneous in its coverage. Further, the continuity of trade has been interrupted by the two world wars and by the exchange crises of 1947 and 1949. During each of these periods the quantity, composition and pricing of imports and exports was not that which would normally have been expected. Therefore, the continuity of the ratio through the period is seriously in question.

Although the evidence presented by our indexes should not be taken too seriously, it does show a remarkable stability in the Canadian terms of trade over the past 50 years. The reader is referred to Table 2. 28. The main series is shown in column 1, where the terms of trade index for visible or commodity items has been shifted to a 1949 basis. We see that both 1948 and 1949 were rather exceptional years as would be expected from the fact that in those years exchange conservation controls were applied. In column 3 the same period is covered, but here the two price indexes in the ratio include in their weighting system services as well as goods. The pricing of services such as interest, dividends and insurance is a difficult statistical operation, and rather arbitrary assumptions have been necessary to produce the two underlying price indexes: the National Accounts' implicit price deflators for imports and exports of goods and services. It is necessary to assume constant prices over periods of several years in deflating imports and exports of services; this arbitrary assumption is one cause of the greater stability of the figures of column 3 than of those in column 1.

Our knowledge of the terms of trade previous to 1926 depends on pioneering work done by Mr. K. W. Taylor, which was summarized and linked to the then-current D.B.S. price indexes by Professor W. A. Mackintosh in his study for the Rowell-Sirois Commission. Since this index has been calculated so that 1926=100, and since our subsequent series is at *about* this level in 1926, no mechanical operation has been attempted with the earlier data to form a smooth transition between the two series.[14]

[14]A recent review of the evidence and an analysis of the Canadian terms of trade to 1913 will be found in G. M. Meier, "Economic Development and the Transfer Mechanism: Canada, 1895-1913", *Canadian Journal of Economics and Political Science*, XIX, No. 1, February, 1953, pp. 1-19.

Table 2. 28

THE CANADIAN "TERMS OF TRADE" SINCE 1901

	Goods		Goods and services
	D.B.S. 1949=100 (1)	Mackintosh 1926=100 (2)	National Accounts 1949=100 (3)
1901-05 average	—	96.8	
1906	—	97.6	
1908	—	98.5	
1910	—	105.8	
1911	—	103.8	
1912	—	104.4	
1913	—	88.6	
1914	—	96.0	
1915	—	100.8	
1916	—	88.7	
1917	—	95.9	
1918	—	93.1	
1919	—	96.6	
1920	—	99.6	
1921	—	110.1	
1922	—	94.3	
1923	—	85.0	
1924	—	91.1	
1925	—	99.0	
1926	101.2	100.0	102.9
1927	102.2	100.1	104.6
1928	100.3	98.0	102.9
1929	101.5	97.8	101.6
1930	97.4	92.5	100.0
1931	95.6	—	94.3
1932	87.8	—	87.0
1933	90.6	—	93.6
1934	91.2	—	95.5
1935	94.8	—	98.7
1936	98.2	—	101.4
1937	104.4	—	102.9
1938	99.1	—	101.8
1939	95.0	—	98.2
1940	93.4	—	97.1
1941	89.5[a]	—	94.8
1942	86.1[a]	—	91.9
1943	86.9[a]	—	89.9
1944	92.1[a]	—	94.3
1945	96.1[a]	—	98.2
1946	103.6	—	104.6
1947	103.4[b]	—	104.3
1948	99.3[b]	—	100.0
1949	100.0[b]	—	100.0
1950	97.5	—	96.7
1951	96.8	—	96.8
1952	109.6	—	103.2
1953	107.4	—	100.8
1954	104.4	—	99.7
1955	105.6	—	103.0

See following page for footnotes.

If we now assume that the underlying data are satisfactory, that the price indexes are appropriate and that the link at 1926 does not conceal fundamental changes in that year, we may conclude from the elongated series that the terms of trade of Canada have maintained their constancy in spite of fluctuations in periods of depression and boom. The type of secular decline experienced by the United Kingdom to which we referred above is not exhibited here. It may well be that as world markets have altered their preference for various types of goods, Canada has kept pace, altering the composition of her production, so that the prices of her exports have not lost ground in the race with the prices of goods which she must import from heavy manufacturing areas and from more tropical climates.[15]

We are left, therefore, with the conclusion that change in the terms of trade need not necessarily illustrate the course of economic progress; while undoubtedly a nation with an undiversified economy depending continually on a single exported commodity would suffer reverses in its terms of trade if that product declined in demand relative to its demand for other goods, it does not follow that the terms of trade of other economies with more diversified production opportunities selling in unrelated markets need progress through any particular series of stages, other than those associated with the fluctuations of the short business cycle. For this reason, we do not emphasize the terms of trade as a manifestation of economic growth, nor shall we in Chapter 3 employ any assumption about the terms of trade in building our model of economic growth.

While exports and imports are of course profoundly important economic contacts between nations, in Canada exports and imports have been declining as a proportion of national output or expenditure. But there are other important links between economies. The long-run movements of the factors of production, labour and capital, as well as the cultural contacts provided by the interchange of people, knowledge and tastes, have important economic consequences. We shall concentrate here on movements of labour and capital, and we turn first to international migration.

[15]See D. W. Slater, "Changes in the Structure of Canada's International Trade", *Canadian Journal of Economics and Political Science*, XXI, No. 1, February, 1955, pp. 1-19, for a discussion of this explanation pertaining to the period 1896-1950.

FOOTNOTES TO TABLE 2. 28

a War years: data reflect prices of commodities traded in peacetime.

b Exchange conservation controls.

SOURCES: 1901-30: W. A. Mackintosh, *The Economic Background of Dominion Provincial Relations*, Tables 3 and 5. Export prices as percentage of import prices. 1913-20 the export and import prices are D.B.S. Prior to 1913 Taylor's indexes of average valuations. Since 1920, D.B.S. price indexes.

1926-55: D.B.S., Review of Foreign Trade, first half year, 1954, Table 12. The "domestic exports" and "imports" price indexes have been mechanically adjusted to 1949=100. Price indexes and terms of trade for the war years are not subject to the usual interpretation.

1926-55: *National Accounts, Income and Expenditure 1926-1950* and *1950-1955*, Table 3. The implicit price deflators for imports and exports (which include payments for invisible items) have been mechanically adjusted to 1949=100.

Immigration rarely occurs when an economy is depressed. To the contrary, it is during rapid growth, or during the upswing and prosperity phases of a business cycle, that countries like Canada and the United States have welcomed the greatest inflows of migrants. Correspondingly, it is a general rule that countries and regions lose population when business activity and opportunities in the domestic economy are discouraging. But since the correspondence of these movements with phases of home depression and of foreign economic exhilaration has not been perfect, there has been considerable controversy as to whether it is the pull of foreign conditions or the push of home conditions that encourages migration during industrial fluctuations.

In the longer run, the problem is akin to that we noted earlier in our discussion of population movements among regions; the same tangled skein of personal, social and economic motives lies behind the relationship between the rates of population growth of national economies. We may repeat a question posed there: does international migration equalize or further separate disparate rates of economic growth? Data on national incomes and populations are more plentiful than data on regional incomes and populations, and more research on the determinants and consequence of international migration (especially from Europe to the New World) has been undertaken. Although much has been learned from such research, there is still much to be learned.

A particularly noteworthy recent work by Professor Brinley Thomas, *Migration and Economic Growth,* contains an investigation inspired by the suggestion of Professor Joseph Schumpeter in connection with cycles of economic activity, and Professor Simon Kuznets in respect of the so-called minor secular cycle. We have mentioned that economists have discussed the relative importance of the pull of conditions in the receiving countries, and of the push of poor economic or social conditions in the country of origin of the migrants. Viewing the problem in terms of the approximately ten-year business cycle of the nineteenth century, it appeared that the favourable economic circumstances of the receiving country, that is the pull, exerted the greatest forces, since migrants seemed to be leaving their homes regardless of the conjuncture of domestic business activities at that time. The researches of the economists we have just mentioned, however, suggest that the short ten-year business cycle is less relevant for the study of migration than the so-called minor secular cycle of from 17 to 20 years, which is best known to many persons through its manifestation as a building cycle in North America. These economists have considered within the full North Atlantic economic community of the nineteenth century the timing and pervasiveness of these minor secular cycles among the nations making up the community. Evidence has been unearthed which suggests that during rapid growth in one part of the system—that is, during an upswing of this longer cycle—there has been an accompanying but lagged inflow of migrants and a

simultaneous downswing in the economies whence the immigrants came. One example of this kind of analysis is given in Table 2. 29, which shows that the American decades of most rapid growth were those in which immigration from the United Kingdom increased most rapidly (with a lag of about five years). Other tables in Professor Thomas' work are intended to establish that when the American rate of growth of income per capita was high the British rate was low, so that British savers invested their capital in the American market. Conversely, when British growth was high, the American economy was in the doldrums, British savers found it most profitable to contribute to the equipping of British industry, and British workers showed little disposition to migrate. Our particular interest in this elaborate hypothesis is that in it migration is seen as part of the transmission mechanism of rates of growth of one country to other countries. Rapid growth in one place invites the movement of goods, capital and people, so that the other economies, through these various contacts, are in part carried along by the wave of progress that has reached one part of the larger economic community.

Table 2. 29

RATES OF INCREASE IN U.S. INCOME AND IMMIGRATION

(percentages of previous overlapping decade)

Decade (yearly average)	Real national income per capita	Net immigration from United Kingdom
1874-83	29.3	104.0
1879-88	17.3	74.4
1884-93	5.5	–18.7
1889-98	3.8	–37.9
1894-1903	12.3	–29.8
1899-1908	14.2	41.4
1904-1913	9.6	4.7

SOURCE: Brinley Thomas, *Migration and Economic Growth*, Cambridge, 1954, Table 30.

The second of the long-run factor movements which forms a contact between growing economies is foreign investment. When economic growth and a high propensity to import consumer goods threaten to exhaust an economy's powers of drawing on foreign sources of supply, the gap might be filled by increased lending by the rest of the world. Indeed, the economic growth may take the specific form of real investment financed by foreign investors who themselves thus provide the means by which the required capital goods may be imported. In the Canadian context, such increase in foreign indebtedness appears to have been an inevitable concomitant of economic growth. The savings of Canadians, high as they are, have been insufficient to cover the many investment opportunities existing in the boom economy. Similar experience has been noted in other economies at given periods in their histories, so that one well-known generalization about economic growth has suggested that growing economies pass through a succession of stages from immature debtor, when exports are insufficient to finance

either imports or even the service on the debt, to mature creditor, when conceivably a country might finance all its imports with the interest earned on past lendings.

However, so much depends upon the outcome of the race between the appearance of new investment opportunities (caused by new resource discoveries and needs, population growth and technical change) and the flow of new savings (the determination of which is dominated by a multitude of individual decisions about insurance, retirement, risk, dividend policies and fiscal policy) that we believe any summary proposition can refer only to a particular country at a particular point in its path of development.

Net foreign lending or borrowing has two consequences which we shall merely point out without the discussion they invite. In the first place, net foreign borrowing leads to an increase in the foreign ownership of Canadian securities (though it need not lead to an increasingly preponderant foreign ownership of all Canadian securities). If these securities are in the form of bonds, they lead to an inflexible burden of debt service which may provide cause for concern over subsequent rises and falls in the business cycle. If, on the other hand, these securities are equities, it leads to an increase in foreign ownership and control of Canadian enterprise. The economic aspects of these two manifestations of increasing indebtedness are discussed in this Royal Commission's study of Canadian-American economic relationships.

In the second place, net foreign borrowing leads to a flow of interest and dividend payments abroad in subsequent years. Whether the flow increases as a percentage of the G.N.E. or not depends upon whether the total of net foreign indebtedness is rising more or less rapidly than the G.N.E. and upon whether foreign-controlled firms are remitting dividends abroad or are plowing profits back into the Canadian economy. The total flow of interest and dividends has been decreasing in past years as a percentage of the G.N.E. suggesting, as in fact is believed to be the case, that in the long run foreign indebtedness has not grown as rapidly as the G.N.E. and that foreign investors have re-invested a large part of their earnings in Canada. In Table 2. 30 we present some evidence on this subject. Evidently the net balance of payments of interest and dividends has not risen as rapidly as the G.N.E. since 1926, though total indebtedness has displayed more rapid increase since 1951.

In some economies, this flow of interest and dividends abroad is likely to assume significant proportions. Indeed, it is often important to distinguish between the Gross National Product (the product accruing to nationals, regardless of its origin) and the Gross Domestic Product (the output produced within the geographical confines of the country, regardless of its ownership), because there may be a large difference between them. This is

done, for example, in the official statistics of the United Kingdom, and in our own work in later chapters on Canadian output. The chief source of the difference between the two measures is the net flow of interest and dividends, though wages and salaries paid in one country to nationals of the other are also significantly large in a few border communities. Both the growth of an economy servicing past loans by paying interest and dividends abroad, and the level of employment and general business activity may be understated by the G.N.P. However, in Canada the small size of the proportions in column 2 of Table 2. 30 suggests that the difference between G.N.P. and G.D.P. is much less important for understanding Canadian growth and activity than are such international trade variables as the terms of trade, tariffs, the elasticity of foreign demand, and currency availabilities. As the table suggests, only in the depression of the 1930's was the net balance of interest and dividends large enough to require separate analyses of the growth of the G.N.P. and the G.D.P.

Table 2. 30

CANADA: INTERNATIONAL NET INDEBTEDNESS, SELECTED YEARS, 1926-55

(percentage)

	Ratio of net foreign indebtedness to G.N.E.	Ratio of net balance of interest and dividends between Canada and all other countries, to G.N.E.
1926	96	3.8
1929	—	4.4
1930	117	—
1933	177	6.3
1939	96	2.3
1945	32	1.4
1946	32	2.0
1948	24	1.6
1950	22	2.1
1951	21	1.6
1953	24	.9
1955	28	1.2

SOURCES: Column 1: D.B.S.: *Canada's International Investment Position 1926-54*, Table 1. Indebtedness is roughly definable as foreign capital invested in Canada and in Canadian property abroad, minus Canadian capital invested abroad; both terms include official holdings of exchange, but exclude short-term commercial indebtedness and blocked currencies; values are at year ends.
Column 2: *National Accounts, Income and Expenditure, 1926-1950* and *1950-1955*, Table XVIII, line 13.
See also: *Canada's International Investment Position, 1926-1954*, pages 56-63.

We cannot, within the scope of this chapter, attempt an estimate of the importance, as links between growing economies, of the flows of ideas, tastes and technology. These flows are particularly large among the three economies that we have examined, but we are aware also that today, among most economies, language barriers and political differences do not long inhibit the communication of discoveries and of production methods, and this is particularly true if economies trade directly with each other, if their exports

compete in common markets, or if they compete for raw materials or other imports.

The reader may, however, agree that the statistically measurable long-run links between growing economies are many and strong, and that the cultural contacts would have similar effects. Though their detailed effects are varied, all of them tend to bring the rates of growth of members of the international economy into greater agreement than would exist in their absence. We are impressed by the close contacts existing between neighbouring economies, and even more impressed by the locking action imposed on their growth rates by flows of capital and of labour. When such flows, and flows of currently used goods and services, exist, from many points of view the economies blend into one, or at least the boundaries between them become hazy and difficult to distinguish. The more numerous these contacts, the more similar will be the rates of growth.[16] We revert to this point in the following chapter.

III. From Record to Theory

Clearly, an attempt to set out a record of economic growth within the space we have allotted ourselves in this chapter would have been a hazardous enterprise. We should emphasize that to set out the full record has not been our intention nor our achievement. Instead, we set ourselves the task of discovering whether there was any pattern to be seen in the myriad statistical manifestations of economic growth. We have noted some of the patterns emphasized by other writers, particularly patterns in the changing industrial composition of the national output, the changing share of labour in the national income, the changing terms of trade between primary and manufacturing economies, and the changing role of energy and natural resources in a period of growing populations, and we believe them, for the most part, to represent helpful insights into the process of growth. We ourselves have been particularly impressed with what we believe to be two outstanding characteristics of the development of mature economies:

(a) national economic development, in spite of fluctuations, manifests itself in a multitude of statistical time series, both specific and aggregative, whose rates of growth are surprisingly similar to those of comparable series in other economies, and

(b) within a given economy, in spite of fluctuations within the shorter period, the ratios between the items of certain pairs of economic time series maintain a surprising constancy, either of value or direction of change.

[16]We do not wish to be misunderstood on this point. We have not contended that the rates of growth of the countries we have studied have been shown to be equal for every indicator we have selected. We only contend that contacts among economies in and of themselves diminish disparities among national rates of growth. Differences in the climate of enterprise, the effects of technological change on the demand for particular resources, and the ravages of war, to mention only a few illustrations, may and do inhibit the operating of the forces to which we have drawn attention.

In the following chapter we shall analyze these two generalizations and in the subsequent chapters we shall emphasize them in developing our forecasts.

Before concluding, we must reiterate the warnings throughout this chapter about the nature of the underlying statistics. Most of the basic estimates were not calculated for the purpose of making long-period comparisons. In many cases they represent the outcome of splicing together once, twice, or more times statistical time series published by different authors to illuminate different problems. Each long series is therefore necessarily of rather uncertain quality as a means of comparing the rates of growth between its extremes. We only compound the uncertainty when we take the ratio, over time, of any series to another of equally uncertain homogeneity over time. The time path of the resulting ratio can at best only be indicative of rough constancy or of continuing change. We would be very neglectful of our duty to our reader if we left the impression that we attach great importance to the absolute value of a ratio at any particular time or to the value of its compound rate of change over time. Nor must we forget that our estimates measure variables which, far from growing steadily, fluctuate in sympathy with general and specific business conditions. Viewed over a long period of time, such fluctuations may be regarded as though they averaged out; but recourse to this concept is less helpful at the beginning and at the end of the series. We do not know what lies beyond the extremes; hence we cannot be certain that what appear at the extremes to be short-term dips or peaks are not actually evidence of changes in long-term trends, knowledge of which might lead us to modify some of our conclusions about the tendencies we have seen in this chapter. For such reasons we have sketched the pattern in broad strokes; statistically, much remains to be done before its details are clear.

Having thus warned the reader, we now present briefly a classification of what we believe are key ratios in the analysis of economic growth.

Among the constant relationships, as far as our statistics allow us to call anything in economic life constant, may be numbered the following:

(a) an approximately fixed relationship between saving and output

(b) a related constancy of the ratio of capital to output

(c) a significant stability of the ratio of labour income to national income

(d) a limited range of variation among the rates of growth (especially of output or income per head) of mature economies or of the regions of an economy.

Among the ratios and relationships between growing variables which were found themselves to be growing—that is, the rates of growth of numerator and denominator were different—may be numbered the following:

(a) output per worker and output per man-hour of work

(b) income per unit of work; that is, wage rates

(c) the ratio of capital stock to labour input

(d) the ratio of leisure to other types of consumption

(e) the ratio of output to energy consumed.

There is a third set of ratios, the long-run direction of which is unclear, and on which present evidence is inconclusive:

(a) the proportion of the population that is in the labour force

(b) the proportion of the national expenditure that is imported

(c) the proportion of the national output that is exported.

3

THEORY OF ECONOMIC GROWTH

I. *Introduction*

In the last chapter we reviewed alternative ways of describing economic growth and an array of empirical facts relating to the long sweeps of economic development. Now, in anticipation of subsequent chapters in which forecasts of pertinent indicators will be made, we must direct our attention to a few problems in the analysis of economic growth. However, our treatment will be modest and is intended to be.

In what follows we shall concentrate on the nation's output and output per head[1] as measures of economic growth, but of course, the development of other related quantities, including components of output and income, will receive considerable incidental attention.

The theory of economic growth is not a neat little island in the literature or subject matter of economic theory. Interest in the nature and problems of growth is currently very high. This is partly because the grand strategies of world politics focus attention, on the one hand, on relative rates of advance of more mature economies, especially those based on large continental land masses and, on the other hand, on the problems of assisting the so-called underdeveloped countries to realize their national economic (and political) aspirations. But economists have long considered the question under a variety of stimuli, and, moreover, there is little economic theory, from the discussions of value, distribution and allocation to the theory of fluctuations, that is not germane to the analysis of trends in activity.

In spite of the extensive literature on the subject and probably because of the pertinence of so many theoretical considerations, there does not now exist an accepted general theory of economic growth. (We shall not remedy this deficiency.) There is, however, perhaps some agreement that one may delineate at least three basic determinants of the rate at which an economy

[1]Especially output per head of the employed labour force.

can increase the size of the product that it wrests from the natural resources at its command. The use of the word "basic" derives from the consideration that although there may be some reciprocal relation between these determinants and the development of the output of the economy, the effect of these determinants on the growth of output may be expected greatly to exceed the effect of the growth of output on the evolution of the determinants. The three determinants we have in mind may be labelled the spirit of the people, the institutions through which economic activity is organized and the knowledge of techniques.[2] Let us briefly discuss each of these in turn.

By "the spirit of the people" we mean such characteristics as their interest in promoting economic well-being as compared with other objectives. their attitude to work versus leisure, and their attitude to taking risks, such as those associated with changing occupations or employers and with introducing new products and methods. By and large we would expect economic growth to be more rapid, the more interested people are in acquiring the fruits of economic effort and the more they are willing to take the risks associated with the changes that are the very essence of rapid development.

By "economic institutions" we refer to the complex system of rules and practices followed by governments, individuals and groupings of individuals in conducting economic activity. Institutions provide a vital means by which the willingness of the people to work and to take risks is effectively directed. We would not argue that there is only one set of institutions that is most effective in this sense for all peoples and all times; we only assert that growth will be the more rapid if institutions do not thwart the spirit of the people.

The knowledge of techniques for most fruitfully applying labour to capital and resources to yield goods and services is clearly of vital importance in economic growth. We do not wish here to distinguish carefully between institutions and techniques. The distinction is ultimately arbitrary, for techniques are also rules and practices. The rules or practices governing say the establishing of corporations and relations between management and labour differ only in degree from the rules by which factors of production are combined in the factory. In recognition of the arbitrary line between institutions and techniques, we shall use the word "innovation" to refer to changes in either.

There is another determinant of output which we do not consider to be as "basic" as the three introduced above. This is the population of the economy. The rate of population growth is certainly affected by the changes

[2]One should not exaggerate even the extent of agreement on these basic determinants. W. A. Lewis, for example, in his *The Theory of Economic Growth* (London, 1955), distinguishes three "proximate" causes of growth: "the will to economize", "the increase of knowledge and its application", and "the amount of capital or other resources per head" (p. 11). It seems to us that the quantity of capital per head is much more responsive to the state and development of the economy than the other two proximate causes which we too have selected. W. W. Rostow in his *The Process of Economic Growth* (New York, 1952), suggests a somewhat different set of determinants or proximate causes. See also, M. Abramowitz, "Economics of Growth", in *A Survey of Contemporary Economics*, Volume 11, ed. by Bernard F. Haley, Homewood, Illinois, 1952, especially p. 134.

in economic activity; it would presumably not be argued however that population is as responsive to changes in the level of prosperity as say investing in capital equipment. We shall accord population an intermediate status as a determinant of economic growth not quite so basic as the spirit of the people, their economic organization and technical knowledge.

In this chapter, in which we are concerned essentially with economic growth in countries such as Canada, the United States and the United Kingdom (as contrasted with comparatively less mature economies), we shall at all times take the spirit of the people as given.[3] For part of the analysis we shall suppose that the introduction of innovations and the increase of the population proceed at rates that are in no wise determined by the course of economic activity. Later this assumption will be progressively relaxed as we discuss the relation of the introduction of innovations to the phases of the business cycle, the responsiveness of the character of innovations to relative factor shortages in the economy, and one or two aspects of the relation between population changes and economic changes. However the analysis of the effects of economic growth on population and innovations will be even less complete than the analysis of economic change under the influences of continuing innovation and rising population.

In Part II of this chapter we shall be concerned with relations among the levels of economic variables such as income, employment, the stock of capital, saving and investment, earnings of labour and capital, and the like, when the rates of change of these variables are in equilibrium or are proceeding toward equilibrium. We shall consider especially the changes in levels and in rates of growth that result from changes in assumptions concerning the growth of the population and the rate of introduction of innovations. The analysis here will be analogous to the equilibrium theory of economic statics.

In Part III, our subject will be the interrelations of cycles and trends in the main economic magnitudes.

In Part IV we discuss briefly the relation between the theoretical views set forth in this chapter and the forecasts presented later in the book.

II. *Growth and Equilibrium*

In Chapter 2 we drew attention to several empirical trends that seemed sufficiently well established to warrant analysis. Among these were the following:

(a) the comparative constancy of the ratio of saving to income over the long run,

[3]That is, in a broad way. We shall, however, refer specifically to changes in confidence over the course of the business cycle.

(b) the absence of any pronounced long-term movement up or down in the ratio of income to capital (or as it is often expressed, the capital-output ratio),

(c) the rising trend of income and output, each per head,

(d) the fairly constant share of the earnings of labour in national income,

(e) the rising trend of the ratio of capital to labour,

(f) the rising trend of real wages,

(g) the comparatively level trend in the rate of return on capital.

Some of these empirical trends, especially the first three, lie at the heart of the forecasting methods used later in this study.[4] We wish, in this and the next part of the present chapter, to study some of the implications of these empirical findings and to examine possible explanations for them. Let us warn the reader immediately however, that by and large economists have, at best, only tentative explanations of them to offer. It follows that forecasts drawing upon such analysis must be regarded as correspondingly conjectural.

We shall begin the analysis by concentrating on some implications of the trends and gradually, as we proceed, turn to the problems of explaining them. There must necessarily be a considerable atmosphere of fiction or unreality about the analysis of the implications of trends. This is because trends themselves are fictions. Trends are an *ex post* interpretation and summary of events. But, as the data have shown us, the economy does not develop along trend lines; the indicators of economic development show a wide variety of jerky, irregular movements and even these are the record of such few of the full details of economic experience as can be reduced to numbers on a graph. Trends, being interpretations, are the consequences of day-to-day experience; they are neither the essence nor the cause of experience. Lest we arouse the interest and criticism of the philosopher we shall not develop this point further. The conclusion we draw is that a study of the implications of trends is essentially a logical study of the compatibility and the interrelationship of trends. In other language, it is a study of equilibrium among growth rates.

Some of the questions of compatibility are obvious, and may be settled by using a little arithmetic. For example, if the ratio of capital to labour rises, and if the ratio of capital to output does not change, then necessarily the ratio of output to labour rises. There are more than a few obvious arithmetical propositions of this kind to be found in the literature of economic growth. There are other propositions concerning equilibrium among rates of growth that derive from rather more sophisticated analysis. The increase in

[4]The precise wording should be noted. The method of forecasting was *not* simply to project some statistical computation of these trends. Rather we have studied the trends, movements about the trends and such explanation of the trends as could be adduced, and in the light of this study have arrived at projections. It may be of course that events will show that the extra effort did not improve the forecasts.

sophistication arises from the addition of further relationships and restrictions in the analysis.

The question of whether a particular set of trends are compatible or whether a particular set of growth rates are in equilibrium then depends upon the group of assumptions—or in other words, the model—that is used in the analysis. Moreover, it must be anticipated that in general more than one model will yield the same conclusions. We shall not be able here to explore as fully as we should and as we should like, alternative models, and the choices to be made among them. In science, the preferred model is ultimately that which yields the best predictions. There is always some presumption that models whose basic assumptions agree well (in some sense) with our interpretations of experience, will prove to yield the best forecasts, but progress in all sciences provides many surprises in this connection.[5] Since we shall not here be able to compare our forecasts with experience we must be content to work with models of a type that might be presumed to yield acceptable forecasts and to offer some defence of the assumptions (especially in our attempts to explain the patterns we have observed). All of this amounts to declaring that economic science has not a long record of successful predictions to its credit and therefore the forecasts to be supplied in this study must be regarded with some skepticism.

We shall not of course confine our study to conditions under which the rates or growth of a particular group of indicators are compatible. We shall be especially interested in the question: At what levels of the variables and at what rates of growth of the variables will equilibrium prevail? Indeed, if we think of the course of variables over time as being plotted[6] on semi-logarithmic paper (on which straight lines represent constant rates of change) we shall be concerned with the level and with the slope of the time paths of variables implied by the model under discussion, both in equilibrium and during the passage from one position of equilibrium to another.

1. *An Economy with One Industry*

Let us begin the exposition of the subject of growth and equilibrium with a particularly simplified model or set of assumptions. Some complications will be introduced subsequently. We suppose the existence of a quite extra-ordinary economy in which output consists of only one kind of good. This good however has two uses; it may be consumed directly or it may be used as capital in the production of further output. There is therefore only one industry in this economy and no trade in goods or securities is conducted with other economic systems so that output is equal to income. Moreover, we suppose that such government as there is, is conducted by members of

[5]For an elaboration of the point, see Milton Friedman, "The Methodology of Positive Economics" in *Essays in Positive Economics*, Chicago, 1953, pp. 3-43.

[6]With the value of the variable on the vertical axis and time on the horizontal axis.

the population in their spare time and that the government has no budget—no receipts or expenditures.

It is assumed that in production, labour (of homogeneous quality) is combined with capital to produce output and that the relationship between inputs and outputs is such that a simultaneous increase of x % in each of the inputs results in an increase of x % in the output. Moreover, we shall not only assume that the "production function" is of this variety (homogeneous of degree one) but that in addition, it is of the special Cobb-Douglas form having constant elasticities of output with respect to each of the factors and the sum of the elasticities equal to unity.[7]

The assumptions we make concerning the population and innovations are the following. It is assumed that the labour force increases at a constant rate and that new innovations are continuously applied so that the amounts of labour and capital required to produce any given output continuously decline each at the same constant rate. Alternatively we may express this latter assumption as follows: the output that may be derived from each combination of inputs grows constantly at a given rate. In yet other language that may be even more familiar, we assume that neutral innovations are introduced at a constant rate. We shall refer to the term in the input-output relation, that defines the levels of output that may be obtained at any time from any particular combination of inputs as the innovation factor.[8]

7 In symbols, the production function is assumed to be of the form $O = AK^{\alpha}L^{1-\alpha}$ (1)

where O represents the level of output, K and L represent the levels of inputs of capital and labour respectively, A is a constant and α is a constant representing the elasticity of output with respect to capital input, i.e $\frac{\partial O}{O} \div \frac{\partial K}{K}$ and

$1-\alpha$ is the elasticity of output with respect to labour input, i.e. $\frac{\partial O}{O} \div \frac{\partial L}{L}$

Cf P H Douglas, "Are There Laws of Production?" *American Economic Review*, Vol XXXVIII, 1948, pp 1-41 and the literature cited therein.

8 The assumption concerning the growth of the labour force may be represented symbolically as

$$L_o e^{nt}$$

where L_0 is a constant, n is the constant rate of growth of the labour force, t symbolizes the variable time and e is the base of Napierian logarithms The assumption concerning the character of innovations may be represented by considering the "constant" A in equation (1) to grow at a constant rate so that it may be replaced by

$$A_o e^{gt}$$

the innovation factor, where A_o is a constant and g is the constant rate at which neutral innovations are introduced We may now rewrite equation (1) as

$$O = A_o e^{gt} K^{\alpha} \left[L_o e^{nt} \right]^{1-\alpha} \qquad (2)$$

One further group of assumptions is made at this point. It is assumed that the proportion of output that decision-makers in the economy, consumers or business firms, decide to devote to increasing the capital stock is a constant. For simplicity we shall assume that capital is everlasting (whether the single class of goods in the stock is used in further production or merely held as inventory for consumer needs) so that replacement expenditures are zero, though the argument may be conducted equally straightforwardly if it is assumed that replacement expenditures are not zero but a constant proportion of output. (See the discussion in footnote 10 below.) The ratio of investment to output may also be viewed as the ratio of saving to output.[9]

Let us examine briefly some of the consequences of these assumptions.[10] The consequences derive formally from mathematical analysis. This will be conducted in the footnotes but in the text we shall state the consequences along with such intuitive demonstration as we are able to manage.

One implication is obvious immediately; namely that the rate of growth of output will vary directly with the rate of expansion of the labour force and directly with the rate at which neutral innovations are continuously introduced. The effects of the saving ratio and the output-capital elasticity on the rate of growth of output however may not be so obvious. Nevertheless they may be explained fairly easily. The rate of growth of output under our assumptions concerning the production function will necessarily be equal to the rate at which innovations are introduced plus the output-labour elasticity times the rate of growth of the labour force plus the output-capital elasticity times the rate of growth of capital. Secondly, we get from the savings relation, that no matter what is the propensity to save, the rate of growth of investment equals the rate of growth of output. We now have through these two propositions an implied relation between the rate of growth of capital and the rate of growth of investment. But investment is the rate of change of capital. We would therefore expect that investment would be higher for given output, the higher the saving ratio, and that capital would grow at a

9

Symbolically, we have $S/O = I/O = s$ (3)

where S is saving and I is investment that adds to the capital stock

If I′, investment including replacement, equals s′O and if replacement, I″ equals s″O, then investment that adds to the capital stock, I, equals I′−I″ equals (s′−s″) O equals sO With these definitions, the formal argument in the balance of Part I applies whether replacement is taken to be zero or a constant proportion of output If capital is not assumed to be everlasting, both investment and saving should be regarded as including depreciation allowances

[10]This simplified model has also been examined by others; in particular see Robert M. Solow "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. LXX, 1956, pp. 65-94, and Harold M. Pilvin, "Full Capacity vs. Full Employment Growth", *Quarterly Journal of Economics*, Vol. LXVII, 1953, pp. 545-552.

The paper by H. D. Dickinson, "A Note on Dynamic Economics", *The Review of Economic Studies*, Vol. XXII (3), No. 59, 1954-55, pp. 169-179, may also be helpful. In the book by Horace Belshaw, *Population Growth and Levels of Consumption with Special Reference to Countries in Asia* (London, 1956), extensive use of the Cobb-Douglas production function is made in analyzing problems of economic growth, especially in underdeveloped countries. A large proportion of this book is germane to our discussion.

rate that depends directly on the saving ratio. However it is easily seen that if the rate of growth of a stock of anything grows at a constant rate, the stock itself will grow at a rate that approaches that same constant rate ever more closely. Though we do not prove it by this argument, there is every presumption that investment in this model would be expected to grow at a constant rate and that therefore the rate of growth of capital ultimately would for all practical purposes equal the rate of growth of investment. Using this result we now have that the rate of growth of investment equals the rate at which innovations are introduced plus the output-labour elasticity times the rate of growth of the labour force plus the output-capital elasticity times the rate of growth of capital. Or, to conclude, the rate of growth of investment (which equals the rate of growth of output always and the rate of growth of capital ultimately) tends toward a value equal to the rate of growth of the labour force plus the ratio of the rate at which innovations are introduced to the elasticity of output with respect to labour.[11] We may further conclude that, if innovations are being introduced, their effect on the rate of growth of output will be enhanced if the output-capital elasticity (which is, by assumption, one minus the output-labour elasticity) is high.

11
The structure of the above argument is as follows

$$R(O) = g + (1-\alpha)n + \alpha R(K)$$

$$R(O) = R(I) \quad \text{at all times and irrespective of s}$$

$$\therefore R(I) = g + (1-\alpha)n + \alpha R(K)$$

$$\text{But ultimately} \quad R(K) = R(I)$$

$$\therefore R(I) = n + \frac{g}{1-\alpha} \quad \text{ultimately}$$

where $R(O) = \frac{dO}{dt}/O$, the rate of growth of output and $R(K)$ and $R(I)$ are similarly defined

The formal proof of the result is the following
From equations (2) and (3), bearing in mind that $\frac{dK}{dt} = I_t$

$$\frac{dK}{dt} = s\,A_o\,e^{gt}\,K^{\alpha}\left[L_o\,e^{nt}\right]^{1-\alpha} \tag{4}$$

The solution of this differential equation is

$$K(t) = \left[K_o^{(1-\alpha)} - \frac{s(1-\alpha)\,A_o\,L_o^{(1-\alpha)}}{n(1-\alpha)+g}\left(1+e^{n(1-\alpha)+g}\right)\right]^{\frac{1}{1-\alpha}} \tag{5}$$

where K_0 is the value of $K(t)$ at $t = o$.
From this it is clear that the rate of growth of $K(t)$ approaches the value $n + \frac{g}{1-\alpha}$

We draw attention explicitly to the result that the capital stock grows at a rate ever closer to the rate of growth of output, so that the equilibrium value of the capital-output ratio is a constant.[12] Moreover, since the rate of growth of capital and output in equilibrium exceeds that of the labour force, the ratios of capital and output to labour rise constantly in equilibrium. Since our use of a Cobb-Douglas input-output relation implies that labour receives a constant share of the national output,[13] it follows from the above that labour income per worker will also rise constantly in equilibrium. Application of the marginal productivity theory of wages also gives the same result.[14] Since the share of capital is also constant we also have the result that the return to capital rises at the same rate as income and as capital and hence the return per unit of capital is constant in equilibrium. This too may also be seen by application of the marginal productivity theory.[15]

12
Solow, in his paper "A Contribution to the Theory of Economic Growth", already referred to, made a slip in his analysis of this model with respect to the equilibrium value of the capital-output ratio because he calculated (in our notation) that the R(O) would be

$n + \frac{\alpha g}{1-\alpha}$ whereas in fact it is $n + \frac{g}{1-\alpha}$ the same as R(K). See page 85.

13
For an alternative demonstration that at a constant rate of growth of output, constant capital-output ratio, and constant rates of saving from wages and profits, the shares of labour and capital in national income are constant, see Nicholas Kaldor, "Alternative Theories of Distribution". *Review of Economic Studies*, Vol. XXIII (2), 1956 pp 83-100, especially Part IV

14
The marginal product of labour may be derived from (2) as

$$\frac{\partial O}{\partial(L_o e^{nt})} = C_1 e^{(-\alpha n+g)t} K(t)^{\alpha} \text{ where } C_1 \text{ is a constant}$$

Substituting from (5) we have, essentially, in equilibrium

$$\frac{\partial O}{\partial(L_o e^{nt})} = C_2 e^{(-\alpha n+g)t} e^{(n+\frac{g}{1-\alpha})\alpha t} = C_2 e^{\frac{gt}{1-\alpha}}, \text{ where } C_2 \text{ is a constant}$$

Thus the real income of a labourer rises, in equilibrium at the rate $\frac{g}{1-\alpha}$

15
The marginal product of capital may be derived from (2) as

$\frac{\partial O}{\partial K} = C_3 e^{n(1-\alpha)+g} K^{\alpha-1}$ where C_3 is a constant and on substituting from (5) we have essentially, in equilibrium

$\frac{\partial O}{\partial K} = C_4 e^{n(1-\alpha)+g} e^{-[n(1-\alpha)+g]} = C_4$ another constant so that the real return to capital per unit, is constant in equilibrium.

If labour income per employed worker rises constantly, and saving is a constant proportion of output, then consumption too will be a constant proportion of output (since output less savings equals consumption) and therefore consumption per employed worker will also rise at a constant rate. Moreover, this constant rate is independent of the rate of growth of the labour force so that any increase in the (constant) rate of growth of the labour force will not raise the equilibrium level of consumption per employed worker.

In some of the more recent literature of the theory of economic growth much has been made of the concept of the "warranted rate of growth" and the contrast between this and the "natural rate of growth".[16] Authors such as Harrod, Domar and Hamberg have contended that the economy may develop according to the warranted rate or growth of output, if this equals the natural rate, but if it does so it must travel a very precarious path. "Departure from the warranted line sets up an inducement to depart further from it" according to Harrod.[17]

This point of view has its merits but it seems to us to use the notion of equilibrium to stress the instability of the short run.[18] In our view, unstable equilibria leave equilibrium analysis (whether in statics or the theory of growth) rather barren. Indeed the authors we have mentioned provide very little discussion in their essays on growth of how the economy may be rescued from the abyss toward which it heads when equilibrium is disturbed. But history surely indicates that the equilibrium has often been disturbed and economies just as often rescued. The argument that we present in this chapter is that the short run is characterized by instability but that short-run changes are contained and reversed by the fundamental equilibrating forces that assert themselves over the longer run. Progress of the economy described by the model we are exploring in this first section where we abstract from the instabilities of the short run, is always toward an equilibrium path along which the warranted rate equals the natural rate. It may be demonstrated that the capital-output ratio in the model under discussion tends toward the ratio of the marginal propensity to save (s) to the sum of the rate of growth of the labour force (n) and the ratio of the rate at which technical

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[16]See especially Roy F. Harrod, *Towards a Dynamic Economics,* (London, 1951) and R. F. Harrod, "An Essay in Dynamic Theory" originally published in the *Economic Journal* and reprinted in *Economic Essays* (London, 1952) Essay 13. See also D. Hamberg *Economic Growth and Instability* (New York, 1956) and E. D. Domar, "Capital Expansion, Rate of Growth and Employment", *Econometrica,* Vol. 14, 1946, pp. 137-147, and E. D. Domar, "Expansion and Employment", *American Economic Review,* Vol. 37, 1947, pp. 34-55.

[17]"An Essay in Dynamic Theory" reprinted in *Economic Essays, op. cit.,* p. 265.

[18]Hans Brems has recently related the instability of the Harrod path of growth to the length of the time unit on which investment planning is based. See "Stability and Growth", *Economic Journal,* Vol. LXV, 1955, pp. 615-625, and also "How Induced Is Induced Investment", *Review of Economics and Statistics,* Vol. XXXVII, 1955, pp. 267-277. In the second article he concludes, "Although for obvious reasons little reliance can be placed upon the exact numerical result achieved, the length of the time unit required for stability nevertheless appears quite impressive—between four and eight years." It may be commented that in the absence of short-run instabilities, planning periods might very well be considerably longer, and the Harrodian equilibrium stable. But an analysis that abstracts from short-run instabilities is unsatisfactory.

innovations are introduced (g) to the output-labour elasticity

$(1-\alpha)$, i.e. K/O approaches $\frac{s}{n+g/(1-\alpha)}$[19]. However $n+\frac{g}{1-\alpha}$

would appear to be the way in which we should represent the natural rate of growth, whereas the warranted rate of growth is usually defined as $s \div K/O$. On these definitions, since

$$s \div K/O \text{ approaches } n+\frac{g}{1-\alpha}$$

we see that the economy approaches the equilibrium condition in which the warranted rate of growth of output equals the natural rate.

Most of the consequences of this model that we have derived so far have been in terms of rates of growth. We must however draw attention specifically to consequences relating to the levels of output and the stock of capital in particular. Consider the course of the stock of capital. While it is the case that the equilibrium rate of growth of capital is independent of the marginal (or average) propensity to save, this is not true of the level of the capital stock. At all times—before equilibrium is reached and in equilibrium—the level of the capital stock will be the higher, the higher is the propensity to save. This hardly needs explanation; we would be surprised if the result were otherwise. Consequently, the level of output also will be higher, the higher is the propensity to save, as it depends directly on the stock of capital.

We may sum up our conclusions concerning the course of output or capital with the aid of the schematic Diagram 3. 1. We plot the logarithm of output or capital (which varies directly with the level of output or capital) on the vertical scale, as then a constant rate of growth appears as a straight line. Output or capital will rise at a progressively increasing or decreasing rate (depending upon the initial levels of output or capital) that gradually approaches a constant rate, but at any time the level will be higher, the higher is the saving ratio.

Having examined in some detail this particular example of an equilibrium theory of growth, we pause briefly to reflect further on the character and limitations of such theory. The condition of equilibrium dominates in that the economic system is pictured as being in or as moving toward this condition in which rates of growth are mutually adjusted. It will be noted that in equilibrium in the models of economic growth that are under study

19 This may be seen by recognizing from formula (5) that capital tends to grow as the term

$$\left[\frac{s(1-\alpha)A_oL_o^{(1-\alpha)}}{n(1-\alpha)+g}\, e^{n(1-\alpha)+g}\right]^{\frac{1}{1-\alpha}}$$

grows. Substituting this in formula (2) and dividing it by the result we have the proposition given in the text.

here, it is not the mutual ratios among the variables that achieve "permanent" values but rather the mutual ratios among rates of growth of the variables. Thus output per head continues to rise in equilibrium in the model just examined while the rates of growth of output and of the employed labour force remain constant.

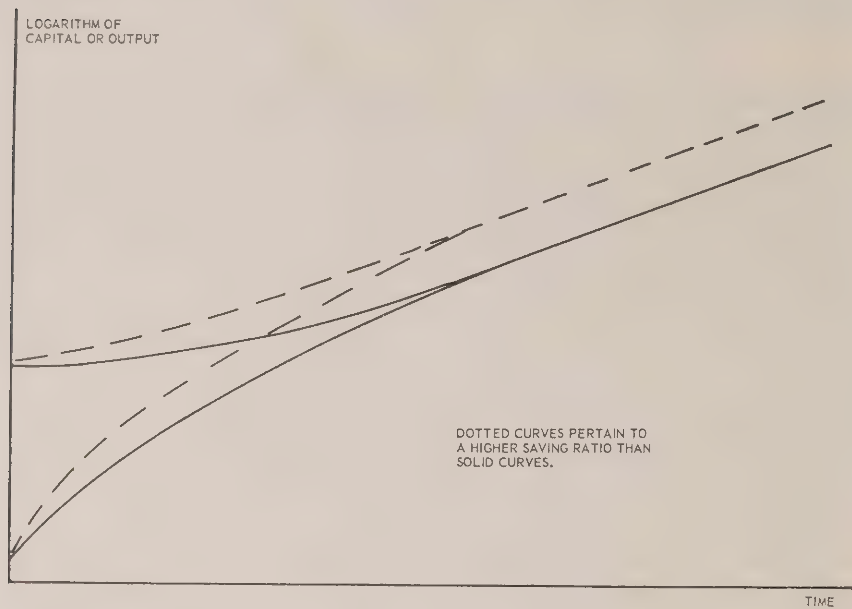

Diagram 3.1

The reader may well ask: But is the condition of equilibrium in such models a very relevant condition? After all, strictly speaking, it is a condition that is only *approached* and not one that is ever reached even in the models. The answer to this question must indeed be made clear if the relevance of the model is to be grasped. Our point of view may be expressed as follows. We do not seek to *describe* with any theory the full detail of the economic process as it evolves. Any theory, whether of the equilibrium variety or not, concentrates on certain features of the process deemed, for the particular purposes in hand, to be essential. We ask the question: What are the rates of growth when they may be regarded, for all intents and purposes, as adjusted to one another? While it is true that in strict theory, perfect adjustment requires the passage of infinite time, the degree of adjustment becomes itself infinitesimal after the passage of relatively short intervals of time and therefore may be ignored. What is perhaps more important is that the economic process as we observe it has itself been continuing for a long time. Moreover, we observe it with quite imperfect techniques of measurement

certainly not adequate to detect very fine shades of adjustment. On the other hand, some propositions derived from an equilibrium theory of growth do not hold merely when the economic system may for all practical purposes be said to be equilibrium, but also during the interval within which adjustments are still occurring. Thus the proposition above, that the levels of output and the capital stock will be the higher the higher is the ratio of saving to output, pertains to a period of transition to equilibrium as well as a period of equilibrium. We note here, as we shall have to note in considerable detail later however, that equilibrium theories are only a first approximation to the economic theory of growth. We have taken the rates of growth of some key variables as given; for example that of the labour force, and the introduction of innovations. Other parameters such as the saving ratio have been taken as given. In more detailed analysis, these assumptions must be relaxed to a degree and we shall be led to adopt a rather different methodology in which we view trends and cycles as intertwined phenomena. But here we are looking for equilibria among trends on a rather more abstract plane. Our programme will be to examine, in the rest of this part, the effects of several complications of the model just presented before going on in Part III to develop a few strands of the theory of trends and cycles. In the end we justify the division of the theory into these two compartments on the grounds that the theory of Part II, the theory of growth and equilibrium, accounts for some of the *grosser* revelations of economic development, while the theory of Part III both amplifies the results of Part II and accounts for some further characteristics of the process.

The first of the complications we wish to introduce pertains to the phenomena of decreasing and increasing returns in the economy. Economists have long discussed the phenomenon of decreasing returns. Viewed in one way, it becomes the very heart of economics—the study of the economizing of scarce means of production. If there were no diminishing returns in the process of combining relatively abundant factors with relatively scarce factors, scarcity would have no meaning and there would be no classical "economic problem" to discuss. If all the means of production were augmentable then future production would depend upon the extent to which current production was devoted to augmenting means (i.e. capital formation). But if some of the means of production are not augmentable, but are nevertheless essential in production, then this fact must diminish the rate of growth of output that would otherwise be possible. The unaugmentable means of production have often been referred to as land.[20] We shall not deny here that there is force to the contention that ultimately, for any economy, there is a limit to the land available to it. We would emphasize however that the distinction between land and capital becomes blurred at the margins. In new countries land has to be discovered and won from nature and this requires capital; in older countries, land can be made, though perhaps at great cost.

[20]But not always or exclusively.

In order to set forth the implications of the existence of an unaugmentable, essential resource called land, we shall first consider the situation in the absence of innovations. Let us modify the assumptions of the model studied earlier, by considering that output is produced by three factors of production, land, labour and capital. We shall suppose that, if the amount of each factor used in production could be increased by x%, output would also be increased by x%, but we assume that in fact the amount of land used in production is fixed. Thus for the range of outputs we shall consider, the whole of the given supply of land is used. If the other assumptions underlying the model are the same as before, save that there are no innovations, then we find that output per head (of the employed labour force) and the stock of capital per head, each fall, while the capital-output ratio remains constant.[21]

We rarely observe an economy in such a condition, and never do we observe this state in one of the so-called developed countries for any extended period of time. Though diminishing returns (to labour and capital) may be operative, presumably their effect is to mitigate the impact of innovations and increasing returns rather than to induce an absolute decline in output per head. But this brings us to the matter of increasing returns.

Adam Smith's dictum that: "the division of labour is limited by the extent of the market" and Allyn Young's recognition of it in his linking of "increasing returns and economic progress"[22] both attest to the venerable status accorded the idea of increasing returns (whether external or internal to the firm and industry) in the economics of growth.

One characteristic source of increasing returns derives, like diminishing returns, from changes in the proportions in which factors of production are used. However, whereas diminishing returns result from what might be termed the progressive over-utilization of the (unaugmentable) resource, land, increasing returns may arise from progressive reduction of the degree

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These, at least are the results if we assume in particular, that

$$O = AK^{\alpha} (L_o e^{nt})^{\beta} Q^{1-\alpha-\beta} \qquad (6)$$

where Q is the quantity of land.
Combining this with equation (2) and solving the resulting differential equation, it may be shown that R (K) and R (O) each approach $\dfrac{n\beta}{1-\alpha}$
which must necessarily be less than R (L) or n.

22

Allyn Young, "Increasing Returns and Economic Progress", *Economic Journal*, Vol. XXXVIII, 1928 pp. 527-42.

of under-utilization of capital or labour. Investment is characteristically lumpy. The classic example is that of transportation equipment; a half of a railway track between two points is useless, but a complete track may not be used fully when it is first laid. An increase in the output of the economy may also result in the reduction of disguised unemployment of labour in some industries and thus result in increasing returns also.

Allyn Young was impressed with what he regarded as the cumulative character of economic progress. Within a somewhat limited framework of analysis he noted that every increase in output widens the scope for the operation of the division of labour and this increased division of labour further increases output and creates additional opportunities. One aspect of this process is the emergence of new opportunities for investment with the growth of the market (either the domestic market, or the whole world market accessible to an economy). Another aspect is the increased ability to devote resources to research which will yield new techniques of production which accompanies increases in output. This cumulative character of economic progress involves the whole vexed question of external economics, the discussion of which has revived with attention to the problems of underdeveloped countries.[23]

Some aspects of the phenomenon of increasing returns may be thought to be represented in the model discussed above by the allowance for the progressive application of innovations. Following Schumpeter, we interpret innovations very broadly, as remarked earlier, to include not only the introduction of new techniques in the narrow sense of engineering but also the adaptation of institutions and practices, resource discoveries, and the extension of transportation into new areas. On this interpretation, innovations include many of the improvements in division of labour that result from and contribute to the growth of output. It will not be argued that all innovations are the direct consequence of increases in output and reflect the phenomenon of increasing returns. Above all we would not contend that in a model embracing one industry and one kind of output and neutral innovations we could hope to reflect the full variety of the phenomenon of increasing returns.[24] Rather, we suggest only that the progressive introduction of innovations allowed for in this model as an autonomous variable may be re-

[23]In addition to the classic paper by Allyn Young cited above, the reader may wish to consult: H. W. Arndt, "External Economies in Economic Growth", *The Economic Record*, Vol. XXXI, 1955, pp. 192-214; P. N. Rosenstein-Rodan "Problems of Industrialization of Eastern and South-Eastern Europe", *Economic Journal*, Vol. LIII, 1943, pp. 202-211; R. Nurkse, *Problems of Capital Formation in Underdeveloped Countries*, London, 1953; Marcus Fleming, "External Economies and the Doctrine of Balanced Growth", *Economic Journal*, Vol. LXV, pp. 241-256; T. Scitovsky "Two Concepts of External Economies", *Journal of Political Economy*, Vol. LXII, pp. 143-151; and J. E. Meade "External Economies and Diseconomies in a Competitive Situation", *Economic Journal*, Vol. LXII, 1952, pp. 54-67.

[24]The model does not reflect, either, the increasing returns that result from the elimination of the under-utilization of labour or capital. While specific instances of such under-utilization can always be cited, it is not always clear that the fuller utilization of specific forms of capital or labour will yield increasing returns on balance, for it may well result in temporary *over*-utilization of some other forms of capital and labour with the accompanying offsetting diminishing returns. Indeed the whole process of growth seems in fact to be accompanied by a continuing substitution of specific bottlenecks of one kind for bottlenecks of another. But this feature of development cannot be elaborated within the framework of a model economy with one industry and one kind of capital.

interpreted as in part reflecting some of the manifestations of increasing returns. We move on now to consider successively more detailed models with a view to reflecting not only further manifestations of increasing returns but further essential features of the economic process generally.

2. *An Economy with Two Industries*

We have been considering a model economy in which only one good was produced by a single industry. This good, however, had two uses; it could be used directly for consumption or as capital. We now consider briefly some aspects of economic growth in an economy comprised of two industries, one producing capital goods and the other producing goods for consumption. Such an economy is of course still a gross caricature of reality, but we hope that a few characteristics of growth and equilibrium may be illustrated by analyzing it. We shall start with an exceedingly simplified version and later introduce a few complications.

We shall suppose that the input-output relation for each industry is of the special Cobb-Douglas form with constant elasticities of output with respect to each of the factors—labour and capital—employed. Moreover, within each of the these industries, the sum of the two output-factor elasticities is unity. At first, we shall impose the additional restriction that the elasticity of output with respect to labour is the same in both industries and, consequently, that the elasticity of output with respect to capital is also the same in both industries.[25] We also assume that innovations of the neutral variety are introduced at constant rates in each industry, but at the moment we do not prescribe any relation between these two rates. We think of them as independent.

As in our earlier model, it is supposed that saving, including depreciation allowances, bears a constant ratio to total output. Employment of labour in the two industries is required to be equal to the total supply of labour which is in turn assumed to grow at a constant rate. The total stock of capital is assumed to be employed and the rate of increase of the stock of capital, investment, is required to be equal at all times to saving.[26]

So far we have specified six relations among seven unknowns: the output of consumer goods, the output of capital goods, the employment of

[25]We do not defend this assumption on any ground other than that it simplifies that part of the analysis on which we wish to concentrate; we shall relax it later. However, if one thinks of the two industries in this model as producing a great variety of consumer goods and a great variety of capital goods, the assumption perhaps seems less unrealistic.

[26]Again as in the case of the one-industry model we take capital to be everlasting, though, as before, the essentials of the argument we wish to make would not be affected if replacement were assumed to be less than total investment and a positive constant fraction of total output.

labour in each of the two industries, the employment of capital in each of the two industries, and the total stock of capital. To complete the model formally, we require an additional relation among the variables. The obvious candidates for selection are (1) the marginal productivity of capital in the consumer goods industry is equal to the marginal productivity of capital in the capital goods industry or, (2) the marginal productivity of labour is the same in both industries. This need to choose confronts us with a dilemma, for we somehow feel that in a competitive economy in which all factors in the long run are mobile, the real rate of return to any one factor would be the same in all industries and, hence, that its marginal productivity would be the same in all industries. We shall cut the Gordian knot arbitrarily by selecting the first of these candidates.[27] We shall argue that we have only been confronted with a dilemma in deciding which factor succeeds in equating its real returns at the margin because we have assumed that the rates at which innovations are introduced in the two industries are independent. This theme—one of the main ones to be developed in the analysis of this two-industry model—we shall return to.

In this model we find that the division of output as between the consumer goods industries and the capital goods industries is constant. This is because we require that investment, the output of the capital goods industries, be equal to saving, which we require to be a constant proportion of

27 The relations among the variables of the model may be expressed as follows:

$$C = A_{o1} e^{g_1 t} K_1^{\alpha} L_1^{1-\alpha} \qquad (1)$$

$$I = A_{o2} e^{g_2 t} K_2^{\alpha} L_2^{1-\alpha} \qquad (2)$$

$$s(C + I) = I \qquad (3)$$

$$I = \frac{dK}{dt} \qquad (4)$$

$$L_1 + L_2 = L_o e^{nt} \qquad (5)$$

$$K_1 + K_2 = K \qquad (6)$$

$$\frac{\partial C}{\partial K_1} = \frac{\partial I}{\partial K_2} \qquad (7)$$

C and I represent the output of consumer goods and capital goods respectively; K_1 and K_2 represent the employment of capital in the consumer goods industry and the capital goods industry respectively, and L_1 and L_2 are similarly the amounts of labour employed in each industry. A_{01} and A_{02} are constants.

total output. As a consequence of this, and the further requirement that the marginal productivity of capital be the same in the two industries, we find that the stock of capital is always divided between the two industries in the same constant ratio as that in which total output is divided between the two industries.[28] The allocation of the labour force as between the two industries is rather different. The ratio of the amount of labour employed in the consumer goods industry to the amount of labour employed in the capital goods industry is equal to the product of the ratio of output in the consumer goods industry to the output of capital goods industry and a factor which varies directly with the ratio of the rate at which innovations are introduced in the capital goods industry and the rate at which innovations are introduced in the consumer goods industry. In other words, the employment of labour in the consumer goods industry varies directly with the output of that industry and inversely with the rate at which innovations are introduced in that industry.[29]

Let us consider now the rate or rates at which output and capital grow in this economy under the assumptions we have made. In the single-industry economy, the rate of growth of capital and output depended upon the rate of growth of the labour force and the rate at which innovations were introduced in addition to the output elasticity of capital. In the two-industry model now under consideration, we have two rates at which innovations are introduced. As one might expect, it turns out that the growth of capital in this economy depends upon an "average" innovation factor which lies between the separate factors of the two industries and which is closer to that in the capital goods industries the higher the saving ratio, given that the

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From equations (1), (2) and (3), we have, $$\frac{C}{I} = \frac{1-s}{s} = \frac{A_{o1}\, e^{g_1 t}}{A_{o2}\, e^{g_2 t}} \left[\frac{K_1}{K_2}\right]^{\alpha} \left[\frac{L_1}{L_2}\right]^{1-\alpha} \qquad (8)$$

From equations (1), (2) and (7), we have, $$\left[\frac{L_1}{L_2}\right]^{1-\alpha} = \frac{A_{o2}\, e^{g_2 t}}{A_{o1}\, e^{g_1 t}} \left[\frac{K_1}{K_2}\right]^{(1-\alpha)} \qquad (9)$$

Substituting from (9) into (8), we obtain $$\frac{K_1}{K_2} = \frac{1-s}{s} = \frac{C}{I} \qquad (10)$$

29

Substituting from (10) into (9) we obtain $$\frac{L_1}{L_2} = \frac{e^{\frac{g_2}{1-\alpha}}}{e^{\frac{g_1}{1-\alpha}}}\ \frac{1-s}{s} \left[\frac{A_{o2}}{A_{o1}}\right]^{\frac{1}{1-\alpha}} \qquad (11)$$

savings ratio is likely to be less than 50%.[30] The rate of increase of total output would ultimately be the same as the rate of increase of capital. This is because (a) ultimately the rate of increase of capital will equal the rate of increase of investment which in turn must equal the rate of increase of the output of consumer goods, and (b) total output equals the sum of the outputs of the two industries.[31]

It need hardly be added that perfectly symmetrical results would be obtained had we assumed that the marginal productivity of labour is the same in the two industries, instead of assuming that the marginal productivity of capital is the same in the two industries.

Suppose now that we require that both marginal productivity restrictions be satisfied. That is to say, that under conditions of competition and mobility of factors, the real rate of return for any one factor is at all times the same in both industries. As we noted above, we now have one too many requirements and, consequently, must expect some further restrictions to be implied. We find in fact that we can no longer regard the ratio of the innovation factors of the two industries as an independent variable.[32] This ratio will now be determined by the model and, indeed, if we adhere to the requirement that the elasticity of output with respect to each factor be the same in

30

Using the results so far obtained and the other equations of the model we derive after considerable manipulation the following differential equation which may be compared with equation (4) in the previous section:

$$\frac{dK}{dt} = s\left\{\left[\frac{A_{o1}^{\frac{1}{\beta}} e^{\frac{g_1 t}{\beta}} \; A_{o2}^{\frac{1}{\beta}} e^{\frac{g_2 t}{\beta}}}{s A_{o1}^{\frac{1}{\beta}} e^{\frac{g_1 t}{\beta}} + (1-s) A_{o2}^{\frac{1}{\beta}} e^{\frac{g_2 t}{\beta}}}\right]^{\beta}\right\} K^{\alpha}\left[L_o e^{nt}\right]^{\beta} \qquad (12)$$

where $\beta = (1-\alpha)$ and the term in the $\{\;\}$'s is the complicated "average" of the innovation factors $A_{o1}e^{g_1 t}$ and $A_{o2}e^{g_2 t}$

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If $R(x) = \frac{1}{x}\frac{dx}{dt}$ it may be shown that $R(x+y) = \frac{1}{x+y}\left[xR(x) + yR(y)\right]$

if $R(x) = R(y)$, $R(x+y) = R(x) = R(y)$.

[32] Though formally it is satisfactory to regard one of the innovation factors as an independent variable.

both industries, we find that this ratio must be equal to unity. Conversely, if we require that the marginal productivity of only one of the factors be the same in both industries, but specify that the innovation factors always be the same in both industries, we imply that the marginal productivity of the other factor will be the same in both industries.

The economic interpretation that we give to this result is the following. Under the condition of this model requiring that saving be a constant proportion of output, the output or sale of the products of both industries must rise at the same rate. Now if the innovation factor in the consumer goods industry exceeds that in the capital goods industry, and if only capital is required to earn the same marginal rate of return in both industries, then a larger proportion of the increase in the labour supply must flow to the capital goods industry than to the consumer goods industry; but a calculation of the ratio of the marginal productivities of labour in the two industries under these assumptions shows that the larger proportion of the increase in the labour supply must flow toward the industry in which the marginal rate of return is lower.[33] This is unnatural. Rather we would expect labour to flow in such a way as to equate its marginal rate of return in the two industries. If we require this however, the capital goods industry would be deprived of labour, its rate of increase of output would be retarded, the consumer goods industry with its easier supply of labour would find its rate of increase of output stimulated, and, under the the conditions of demand implied by the constant saving ratio, profits would be adversely affected in the consumer goods industry and favourably affected in the capital goods industry. These effects in turn might be presumed to lead to a slowing down of the faster rate of introducing innovations in the consumer goods industry and an acceleration of the rate of introducing innovations in the capital goods industry.[34]

There are additional factors, quite apart from those involved in the equilibrating mechanism just described, that operate on the rate of introduction of innovations in both industries. Non-technical innovations such as adaptations of institutions may well affect both industries equally. External economies also will affect both industries. The greater the weight of such factors as these, the less would be the importance of the equilibrating mechanism in bringing about the equality of the innovation factors in the two industries.

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$$\frac{\partial C}{\partial L_1} \div \frac{\partial I}{\partial L_2} = \frac{A_{01} e^{\frac{g_1 t}{\beta}}}{A_{02} e^{\frac{g_2 t}{\beta}}}$$

[34]The argument may be put in many ways. We have focused on the adjustment of the distribution of labour in the approach to equilibrium; alternatively we might have focused on the adjustment of the distribution of capital. The adjustment process to which we are alluding of course involves shifts of both labour and capital as between industries.

If the innovation factors are always the same in the two industries, the economy behaves in very much the same way as the one-industry economy we studied earlier. Capital grows at a rate equal to the rate of growth of the labour force, plus the ratio of the common rate at which innovations are introduced to the common output elasticity of labour. Output also grows at this rate, so that the capital-output ratio is constant. Indeed, all the propositions derived in the earlier case apply.

Let us now consider the consequences of relaxing the assumption that the elasticity of output with respect to either factor is the same in both industries. We shall not analyze this case in detail. We shall concentrate on the relation between the innovation factors in the two industries on the one hand, and the marginal rates of return to the factors in the two industries on the other hand. With this relaxation of assumption, if we require that the marginal rate of return to each factor be the same in both industries, then the ratio of the innovation factors cannot be regarded as an independent variable. Indeed, it turns out to be equal to the ratio of the elasticities of output with respect to labour in the two industries. In particular, the ratio of the innovation factor in the consumer goods industry to the innovation factor in the capital goods industry is equal to the ratio of the elasticity of output with respect to labour in the capital goods industry.[35] Alternatively, if we *assume* that this latter equality holds, and that only one of the factors has the same marginal rate of return in both industries, we imply necessarily that the other factor also does.

We find that in the present case in which the elasticity of output with respect to any factor differs as between the two industries, the ratio of capital to output will be constant in equilibrium just as it was in the simpler version of the model described above, and for the same reasons. It may also be shown that the share of labour and the share of capital in the national income are constant, that output per head rises at a constant rate, and that the yield of capital is constant.[36]

3. *An Economy with Three Industries*

Let us turn now to consider rather briefly an economy with three industries—one producing capital goods and the others producing consumer goods. It has been rather widely observed that consumer expenditures, on

[35]We shall not give a formal proof of this result. The following argument may, however, have an intuitive appeal. In the single-industry model, we found that the rate of increase of output was equal to the rate of growth of the labour force plus the ratio of the rate at which innovations were introduced and the elasticity of output in respect to labour. In the present case we have two industries whose outputs must grow at the same rate. Moreover, if any factor earns the same rate of return in both industries, the rate of growth of the labour force employed in each industry would be equal to the rate of growth of the total labour force. If, by analogy with the simpler case, we think of the rate of growth of output in each industry as being equal to the rate of growth of the labour force it employs, plus the ratio of the innovation factor in this industry and the output elasticity of labour in this industry, then the proposition in the text follows.

[36]A two-industry model similar to the one described above has been analyzed with rather different emphasis by J. Robinson in "The Model of an Expanding Economy", *Economic Journal*, Vol. LXII, 1952, pp. 42-53. See also her book *The Accumulation of Capital*, London, 1956, which appeared after the manuscript of this chapter had been written.

what we shall call basic goods and services (principally food, shelter and clothing), have been a progressively decreasing proportion of total consumer expenditures in countries characterized by rising income per head. We shall study, in terms of this three-industry economy, the consequences of the assumption that over time the division of consumer expenditures among commodities varies.

In most respects the assumptions we shall make are similar to those we have adopted in studying the one-industry and two-industry model economies. Production in each industry will be supposed to be characterized by a Cobb-Douglas input-output relation. We shall suppose that production in each industry is affected by an innovation factor that reflects the rate at which innovations are introduced in that industry. As before, we shall assume that total consumer expenditures (and, hence, saving) are a constant proportion of output, and that saving is always equal to investment, which, in turn, represents the rate of increase of the stock of capital. It is further assumed that the total labour force grows at a constant rate and is fully employed; the stock of capital also is assumed to be fully employed. We wish, in particular, to examine the consequences of assuming that both capital and labour in seeking to maximize their rates of return succeed in equalizing their respective marginal rates of return among all three industries. Consumer expenditure, we suppose, is divided between the output of basic goods and other goods in such a way that the proportion of total expenditure on basic goods falls at a diminishing rate. It will be a consequence of this assumption that the ratio of the proportionate increase in expenditure on basic goods to the proportionate increase in total expenditure (the elasticity of expenditure on basic goods with respect to total consumer expenditure) will rise at a diminishing rate toward unity. Conversely, the ratio of the proportionate increase in expenditure on other consumer goods to the proportionate rate of increase on consumer expenditure is assumed to fall at a diminishing rate toward unity. Given the assumption that total consumption is a constant proportion of income or output, we may say that the income elasticity of expenditure on basic goods is assumed to be always less than one, and the income elasticity of expenditure on other goods is always greater than one.

The full details of our assumptions are expressed in the footnote attached.[37] But it may be concluded from the above that our assumptions involve some 14 independent relations determining 14 unknowns: the output or sales of the two classes of consumer goods, the output of capital goods, total consumption, the amount of labour and capital employed in each of the industries, the total stock of capital, and three ratios among the innovation factors of the three industries. As before, we find that the tendency of each factor of production to maximize its rate of return operates in conjunction with the conditions of demand for outputs to regulate the relative rates of introducing innovations in the three industries.

It may be a little easier to analyze the character of growth in this situation if we first abstract from the effects of differences in the elasticity of output with respect to labour among the three industries. (We do not regard this abstraction as more than an expository device and we shall drop it shortly.)

We have assumed that expenditure on basic commodities will be a declining proportion of total consumer expenditure, but if a factor of production is to earn equal returns in the two consumer goods industries, the distribution of employment of the factor as between the two industries must be the same as the distribution of expenditure on the output of the two indus-

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The equations of the present model may be written as follows:

$$C_1 = A_{o1} e^{g_1 t} K_1^{\alpha_1} L_1^{\beta_1} \qquad (1)$$

$$C_2 = A_{o2} e^{g_2 t} K_2^{\alpha_2} L_2^{\beta_2} \qquad (2)$$

$$I = A_{o3} e^{g_3 t} K_3^{\alpha_3} L_3^{\beta_3} \qquad (3)$$

$$I = \frac{dK}{dt} \qquad (4)$$

$$\left.\begin{aligned} C_1 &= a_1 + b_1(1-s)(C_1+C_2+I) \\ C_2 &= a_2 + b_2(1-s)(C_1+C_2+I) \end{aligned}\right\} \text{ where } \begin{aligned} &a_1+a_2=O,\ a_1>O, \quad (5) \\ &b_1+b_2=1,\ b_1>O,\ b_2>O. \quad (6) \end{aligned}$$

$$C = C_1 + C_2 \qquad (7)$$

$$C = (1-s)(C+I) \qquad (8)$$

$$L = L_o e^{nt} = L_1 + L_2 \qquad (9)$$

$$K = K_1 + K_2 + K_3 \qquad (10)$$

$$\frac{\partial C_1}{\partial L_1} = \frac{\partial C_2}{\partial L_2} \quad (11) \qquad \frac{\partial C_1}{\partial K_1} = \frac{\partial C_2}{\partial K_2} \quad (13)$$

$$\frac{\partial C_1}{\partial L_1} = \frac{\partial I}{\partial L_3} \quad (12) \qquad \frac{\partial C_1}{\partial K_1} = \frac{\partial I}{\partial K_3} \quad (14)$$

tries, given that the technical coefficients of production (the elasticities of output with respect to each of the factors) are the same in both industries. It follows therefore, that, irrespective of the innovation factors in the two industries, the flow of additional labour and capital to the consumer goods industries must be directed increasingly away from the basic goods industry.[38] However, if the factors of production must always be divided between the two consumer goods industries in the same proportion as their output because of their quest for the same rate of return in the two industries, it follows—just as it did in the two-industry model—that the innovation factors in the two industries must, in equilibrium, be equal.[39] This is so even though the proportion of expenditure on one of the industries is falling and the proportion of expenditure on the other rising. Of course in thinking about this result, it must be remembered that we have not assumed that the basic

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Let $\alpha_1 = \alpha_2 = \alpha_3$ and $\beta_1 = \beta_2 = \beta_3$
Then from (1), (2), (5) and (6) we have

$$\frac{C_1}{C_2} = \frac{b_1 + \frac{a_1}{C}}{b_2 + \frac{a_2}{C}} = \frac{A_{o1} e^{g_1 t} K_1^{\alpha} L_1^{\beta}}{A_{o2} e^{g_2 t} K_2^{\alpha} L_2^{\beta}} \qquad (15)$$

But from (11) $\left(\frac{L_1}{L_2}\right)^{\beta} = \left(\frac{K_1}{K_2}\right)^{\beta} \frac{A_{o2} e^{g_2 t}}{A_{o1} e^{g_1 t}}$

Substituting, we have, $\frac{K_1}{K_2} = \frac{C_1}{C_2}$

Similarly, $\frac{L_1}{L_2} = \frac{C_1}{C_2}$

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Using results derived in the previous footnote and the original equations, especially (8),

we have, $L_1 = (1-s)\frac{C_1}{C} L \qquad K_1 = (1-s)\frac{C_1}{C} K$

$L_2 = (1-s)\frac{C_2}{C} L \qquad K_2 = (1-s)\frac{C_2}{C} K$

$L_3 = s L \qquad K_3 = s K$

Substituting these into equation (15), we have, $A_{o1} e^{g_1 t} = A_{o2} e^{g_2 t}$

consumer goods industry is an absolutely declining industry; we have only assumed that it is declining relatively. Thus in this model economy we expect the output of the agricultural industry and the textile industry as components of the basic consumer goods industry to decline relatively and we expect their employment of factors of production to decline relatively, but we do not expect any differences in the innovation factors of the two industries to persist.

However, we must look for another relation among the innovation factors in the economy, as growth of output in the capital goods industry must be equal to the rate of growth of the output of consumer goods as a whole. The result here is not unexpected in the light of analysis of the two-industry case and of the result we have just obtained. In the two-industry case we found that the innovation factor in the consumer goods industry must equal the innovation factor in the capital goods industry; we now find that the innovation factor in the capital goods industry must equal the common innovation factor in the consumer goods industry.[40] The economic interpretation of both of these results is the same as that given in the analysis of the two-industry economy.

If the elasticity of output with respect to labour is not the same in all three industries, the results must be modified accordingly.[41] In the consumer goods sector of the economy we find that the innovation factor divided by the output elasticity with respect to labour must be the same in the two industries. In the economy as a whole, we find that the innovation factor in the capital goods industry divided by the elasticity of output with respect to labour in that industry must be equal to the common value of this ratio in the two consumer goods industries.

We have not examined the fortunes of an industry whose sales are declining absolutely. It is clear however that the output of such an industry will eventually become zero as will its employment of factors. Presumably the rate of innovation will reach zero much earlier, since profits would be declining and perhaps negative.

Up to this point we have been considering an economy in which the government, if there is one, has no receipts or expenditures and in which there is no trade with foreign countries. We propose now to examine a few of the

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Substituting from previous footnote into equation (8), we have,

$$1 = \frac{\frac{C_1}{C} A_{01} e^{g_1 t} + \frac{C_2}{C} A_{02} e^{g_2 t}}{A_{03} e^{g_3 t}} = \frac{A_{01} e^{g_1 t}}{A_{03} e^{g_3 t}} = \frac{A_{02} e^{g_2 t}}{A_{03} e^{g_2 t}}$$

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It should be remembered that the elasticities of output with respect to labour and capital are together assumed to be equal to one in each industry.

modifications of our results that follow from the relaxing of these two assumptions.

4. *Receipts and Expenditures of Government*

We consider in this section some of the effects on economic growth of receipts and expenditures of government, while continuing to adhere to the assumption of a closed economy. We shall not go into detail, but rest content with a few general propositions and the raising of some broad questions.

There are many aspects of the relation of government policy to economic growth that we cannot even touch upon. For example, stable government that provides efficient administration is one of the economic institutions that we have included among the basic determinants of economic growth. But we cannot here analyze the role of any of these basic determinants. Neither can we consider the vexed questions of establishing priorities among objectives of economic policy and the choice of the optimum fiscal policy for promoting economic growth. The scope of the analysis would have to be widened greatly, beyond the present framework of growth and equilibrium and indeed beyond the framework of economics, were these questions to be treated adequately. We shall direct our attention very briefly to the question: What effect does the diversion of funds through the government sector of the economy have on the rate of growth of output?

We have been led by our earlier analysis to attribute the growth in equilibrium of total output to the rate of growth of the labour force and the rate at which innovations are introduced, and to attribute the level of income at any time to these factors and to the rate of saving. Here we shall concentrate on the effect of government fiscal policy on saving and capital formation, though we recognize that fiscal policy could influence population growth through its effects on the distribution of income, that fiscal policy in a broad sense could affect the rate of immigration and emigration and the health and training of the labour force, and that government encouragement of research could affect the rate at which some kinds of innovations are adopted.

Government expenditures may be channeled into the construction of capital that directly enhances the ability of the economy to produce the goods and services exchanged in the market place. They may be directed to the acquisition of goods and services in the market place for consumption by the government in the process of governing or for use and enjoyment by the citizens. These include the services of civil and military employees and civil and military supplies as well as social capital in a variety of forms. They may finally be directed to the payment of grants-in-aid such as pensions and subsidies which have the effect of redistributing income in the private sector of the economy. If the government borrows the funds it requires and uses these

solely for the purpose of paying grants, the effect on the level and the rate of growth of output will depend on (a) the differences between the saving habits of those who lend to the government and those who benefit from the grants, and (b) the effects of the programme of grants on the operation of the price mechanism in allocating resources. It is clear that if the beneficiaries of the programme of grants spend a larger proportion of their disposable income on consumer goods than those who lend to the government, the rate of capital formation in the economy will be retarded and though the ultimate rate of growth of the economy might not be affected, future levels of income would be lower. It is also possible that the grants may be paid in support of industries that would otherwise decline in importance and so may retard the movement of resources into other consumer goods industries or capital goods industries in which they would be more efficiently employed. On the other hand, it is also conceivable that the grants may be used in support of capital developments by private enterprise in such a way as to effect a net increase in the capacity of the economy to produce. The financing of grants might also be accomplished by taxation or by inflation and, in both of these cases, the effects on the rate of growth and level of output would again depend on the effect of the redistribution of income on savings and private capital formation and on the effects on the allocative efficiency of the price system.

Government expenditures on non-capital goods by definition do not contribute to the growth in the stock of capital. Whether a net reduction in the amount of capital formation follows from the financing of such expenditures depends upon whether the method of financing reduces private saving or private consumer expenditure. If the method of finance is by borrowing, it is possible but not inevitable that domestic saving will be diverted from domestic investment to investment in government bonds. If the method of finance is by taxation, the result depends partly on whether taxes are levied on incomes or consumer goods. If levied on incomes, and if saving tends to be a fairly constant proportion of disposable income, funds again are diverted from domestic investment to government. If taxes are levied on consumer goods, then to the extent that the saving: disposable income ratio is constant, the effect would be a reduction in private consumer expenditures. (This ignores the redistribution of income deriving from the tax on commodities which might in principle result in a change in total saving of some magnitude either way.) If the financing is through inflation, the distribution of the effects as between private production of consumer goods and private production of capital goods will depend upon the extent to which rises in the prices of the factors employed in those consumer goods industries which supply both the government and the private economy are quickly reflected in the prices of other factors. If the inflation spreads evenly throughout the economy, resources will be attracted both from the capital goods industries

and the private consumer goods industries to the production of the goods and services the government consumes. Thus, no matter what the method of finance, it appears likely that if the growth of government expenditure on non-capital goods grows relatively more rapidly than expenditure in the private sector of the economy, private capital formation will be retarded. We may add the reminder that to the extent that government expenditure on non-capital items is directed to research, military or otherwise, that may have applications in production, the retarding effect on capital formation of the economy is countered.

Government expenditure on capital goods by definition contributes to the growth in the productive capacity of the economy. The extent to which this contribution is diminished by the effects of financing the expenditure depends upon the method of financing adopted. The considerations are the same as those adduced in the discussion of financing the expenditure on non-capital items. Undoubtedly some "external economies" flow from government expenditure on capital goods just as some flow also from private capital expenditure and from government expenditures associated with providing efficient administration.

In summary, the diversion of funds through the government has the effect of redistributing income and redistributing production as between consumer goods and capital goods. The greater is the proportion of governmet expenditures devoted to the construction of capital goods, the less is the diversion likely to retard or the more likely is the diversion to enhance the growth in the capacity of the economy to produce. The effects of the diversion on the distribution of private expenditure between capital goods and consumer goods depend in the first instance on the method of financing the government expenditure.

5. *International Aspects of the Theory of Equilibrium and Growth*

We turn now to consider some international aspects of the theory of equilibrium and growth. By and large it is true that there is not one set of economic principles that applies to economic activity within a nation and another set that applies to international economic activity. The theory of international economics differs from the theory of intranational economics only in matters of emphasis. In the former there is a tendency to emphasize immobility of factors of production and technical knowledge as between nations and to stress the possible differences among the monetary and other economic policies of separate nations. These are differences of degree rather than kind however.[42] Moreover, the differences become rather less important in analysis of the long run than they are in examination of the short run.

[42]Cf. Gottfried Haberler, "A Survey of International Trade Theory", *Special Papers in International Economics, No. 1*, Princeton University, 1955.

In our very brief sketch of aspects of economic growth in a closed economy we noted that the mobility of factors of production not only promoted equalization of the earnings of any particular factor in its various occupations but also regulated the rate of introduction of innovations in particular industries. In general, the balancing effect achieved by the price system operating through persons and institutions who insist on buying cheaply and selling dearly is not confined by political boundaries. We do not expect to find the same average level of income per head in all countries any more than we expect individual incomes within a country to be equal. Moreover, we expect that changes in demand and in technical knowledge will provoke a chain of adjustments among nations as well as among industries within a nation. But we further expect that the adjustments will have the effect of inducing similarity rather than disparity among national rates of growth of (say) output per head.

Of course, the extent to which disparities among national rates of growth are controlled, depends on the extent to which the economies are "in contact", to put the matter rather figuratively. In the extreme, if two economies exchange no goods with each other, and if there is no international exchange of persons, capital or ideas, there is no mechanism by which their rates of growth can be adjusted to each other and therefore they might be greatly different and permanently so. The wider the range of contacts, generally speaking, the greater the opportunity of mutual adjustment of growth rates. This will be our principal theme in this section on some international aspects of equilibrium and growth. We cannot argue it in detail in a few brief paragraphs—again we are confronted with the distressing realization that nearly all of the literature is relevant. We shall illustrate the theme with a few hypothetical examples of relations between two countries. We shall have mature countries in mind and avoid the special, though important, considerations pertaining to the growth of underdeveloped countries. Our strategy will be to argue first in terms of relations between two countries which exchange goods and services, but not securities, persons or ideas. We shall then discuss relations between the two when the area of contact is enlarged to include exchanges of securities, persons and ideas. We feel obliged to warn the reader again however, that at no point will the analysis be exhaustive.

If we consider the economic relations between two countries that exchange only goods and not persons, debts or ideas, we must expect to find that the forces making for adjustment of rates of growth to each other will be limited. There are, however, grounds for the presumption that even when the contacts between the economies are thus restricted, the rates of growth of income and income per head will be related to each other and not independent. The main ground for this presumption is that equilibrium in the balance of payments of each country must be established as part of the general equilibrium of the international economy and this means that the values of exports and

imports of each country must be equated at a rate of exchange that is not perpetually changing in one direction. Permanent changes in one direction in any price *ratio* cannot be regarded as a feature of a long-run equilibrium situation.

The definition of equilibrium in the exchange market between two economies is that at the equilibrium exchange rate the value of the imports of one country that are generated by its growth be equal to the value of the imports of the other country that are generated by its growth. More technically, equilibrium in the exchange market implies that the product of the income elasticity of demand for imports and the rate of growth of income be the same for both countries. This condition for equilibrium includes equality of growth rates as a special case; more generally, the equilibrium ratio of the country's growth rates must equal the reciprocal of the ratio of their income elasticities of demand for imports. If the income elasticity of demand for imports is lower in country 1 than in country 2, its equilibrium growth rate must exceed that for country 2.

This condition for equilibrium in the exchange market is exceedingly formal and does not convey a very detailed picture of the adjustment mechanism by which the amounts produced, consumed and traded in each country are drawn into alignment. Let us offer an exceedingly informal sketch of some features of the adjustments. Suppose first of all, that only two commodities are produced, one in each country, and that there is complete specialization of production. Suppose further, that within each country the domestic output is used either for purposes of immediate consumption or for exporting or to increase the stock of capital available for use in production, but that each country's imports are used only for consumption and not to augment the stock of capital. If, under such circumstances, the rate of growth of real income in country 1 is greater than that consistent with equilibrium in the exchange market, its imports will be high relative to its exports and its rate of exchange will rise; that is, its imports will become more expensive in terms of its domestic currency.[43]

In country 1, the relative increase in the price of imports will lead to a substitution in consumption of domestically produced goods for imports. The growth of exports will be enhanced because of the substitution of imported for domestic goods in consumption in country 2. These increased demands on country 1's output will result in diverting more output from investment thus restraining the rise in the capital stock. The effect of this in diminishing the rate of increase of output will be proportional to the

[43]We define a country's rate of exchange with respect to a foreign country as the number of units of its domestic currency required to purchase one unit of the foreign country's currency. The argument in the text—to the effect that the country with the rate of growth above that consistent with equilibrium will suffer a rise in its exchange rate—is based on the assumption that the exchange market is stable, or that in a condition of disequilibrium the direction of movement will be toward equilibrium. No other assumption is possible in a long-run analysis of trends; instability of markets is often an essential feature of the short run. Short-run instabilities will be stressed in the discussion of cycles that follows in Part III of this chapter.

elasticity of output with respect to capital. Since by assumption no capital movements occur, savings must equal investment in each country and thus the diversion of domestic output from investment implies a decline in the ratio of savings to real output. Thus the ratio to real output of the flow of goods (domestic and foreign) into consumption must rise; the rate of growth of consumption may or may not rise. There may also be an effect on the elasticity of demand for imports with respect to real income. The average ratio of imports to real income will fall and hence the elasticity will rise unless the marginal ratio falls at least in the same proportion.[44] The greater the extent to which the (real income) elasticity of demand for imports rises as the exchange rate rises, the greater is the adjustment of the rate of growth of output that will be necessary to establish international equilibrium.

In country 2 imports are cheapened relatively to domestic output and effects opposite to those noted for country 1 will be experienced. A substitution in consumption of imported goods for domestic goods and a decline in the rate of increase of exports will release more resources for capital accumulation. The increase in capital accumulation will enhance the rate of growth of output to a degree proportional to the elasticity of output with respect to capital in country 2. The ratios of saving and imports to real income will rise. The elasticity of imports with respect to real income will fall unless the marginal ratio of imports to real income rises at least in the same proportion as the average ratio. If this elasticity falls, the weight of the adjustment to international equilibrium that falls on the rate of growth of real income in country 2 is accordingly greater.

Thus the equilibrium requires that the rates of growth of real income in the economies be adjusted to each other.[45] Growth of real income, as we have argued, depends on the rate of introducing innovations and the rate of growth of the labour force as well as the accumulation of capital. We shall not attempt to argue the matter with any force here, but we would suggest that even in the model world here under discussion, if the introduction of innovations responds to profit prospects, then the expectation would be that deviations from international equilibrium would move relative profit prospects in the two countries so as to restore equilibrium. For in the country whose rate of growth was relatively too rapid there must be retrenchment and the opposite in the other country. But we shall return to the matter of innovations.

[44]The elasticity of one variable x with respect to another variable y is defined as the ratio of a marginal change in one to the corresponding marginal change in the other divided by the ratio of the magnitudes of the variables.

[45]The reader interested in formal methods yielding this result may consult Harry G. Johnson "Equilibrium Growth in an International Economy", *The Canadian Journal of Economics and Political Science*, Vol. 19, 1953, pp. 478-500, especially Part II and pp. 496-500. The models discussed in this paper are more in the spirit of the Harrod-Domar formulations of the economics of growth than the formulations adopted earlier in this chapter. In spite of this difference however, these models illustrate the point in the text that a necessary condition for *international* equilibrium is that the rates of growth of output not be independent of each other.

Before considering the effects of trade in persons, ideas and debts, we must comment briefly on three of the special assumptions used in the case just considered; namely, that the trading countries are completely specialized, that only two goods are produced and that no capital goods are imported. Let us comment first on the implications of relaxing the assumption of complete specialization.

If some of each good is produced in each country then we must recognize that in either country, growth, by increasing domestic supplies as well as demands, may have the effect of increasing or decreasing the demand for imports. In other words, the elasticity of demand for imports with respect to a country's real income depends on factors determining domestic supply as well as total demand. It is possible to imagine conditions in which growth in a country reduces its demand for imports and if this effect predominates in the exchange market the equilibrating movement in that country's exchange rate will be a fall, and the consequent internal adjustments will lead to a rise in the rate of growth. Essentially, however, the principle is the same as in the case of complete specialization: the ratio of the rates of growth of the two countries is bound in equilibrium to be equal to the reciprocal ratio of the elasticities of demand for imports with respect to real income. But the income elasticities of demand for imports are more complicated under incomplete specialization.[46]

To assume that more than two goods are produced in the world will again only complicate detailed analysis of particular cases and not the principle we are arguing. Troublesome index number problems will not mask the adjustments of rates of domestic growth to the requirements of international equilibrium. Let us examine briefly however a special case of the several-goods situation in which each country produces both consumer goods and capital goods desired by the other and in which, for simplicity, we assume that complete specialization prevails. If the product of the income elasticity of demand for imports and the rate of growth of real income in country 1 is too high relative to this product in country 2, for equilibrium in the exchange market, then country 1's exchange rate will rise. This cheapening of domestic goods will lead to a substitution of 1's goods for 2's in both countries. The increase in exports of both classes of goods from country 1, the increase in output of domestic consumers' goods and the substitution of domestically produced capital goods for imported capital goods all will work to restrain the growth of amounts of resources devoted to capital accumulation and hence to increases in total output. Special features of the economy will dictate the degree of substitutability of domestic consumer goods and capital goods for foreign, and hence the changes in particular

[46]International aspects of growth under conditions both of complete and incomplete specialization are discussed from a somewhat different perspective by Harry G. Johnson in "Economic Expansion and International Trade", *The Manchester School of Economic and Social Studies*, Vol. xxiii, 1955, pp. 95-112. See also W. M. Gordon, "Economic Expansion and International Trade: A Geometric Approach", *Oxford Economic Papers*, Vol. 8, 1956, pp. 223-228.

domestic price ratios and the degree to which capital accumulation will be restrained for any given rise in the exchange rate. But the features of the adjustment in country 1 must be as described and in country 2 they must be opposite in character.

We have seen that with international mobility of goods only, there is nevertheless a tendency for countries' rates of growth of real income to adjust to each other. We have made out no case that rates of growth of real income will become equal; the binding of the rates by the requirements of exchange rate stability is still consistent with widening absolute disparities between income per head in different countries. Let us briefly comment now on the effects of international movements of men, debts and ideas.

In the study of the two-industry case of growth in a closed economy, we noted that if the demands for the outputs of the two industries increased equi-proportionately, freely mobile labour and capital would move between the two industries so as to restrict the ratio of the rates of introducing innovations to the value of the ratio of the elasticities of output with respect to labour. In the international world we must expect to find that mobility of the factors of production will assist in adjusting the rates of introduction of innovations to the conditions of demand for output and the technical elasticities of production.

The general principle of the balancing effect of factor mobility may be put as follows: the tendency is for labour and capital to move toward higher marginal rates of return. In so far as the tendency is effective and these resources do in fact move, they increase relative scarcity and so raise marginal returns in the area from which they leave and have the opposite effects in the area to which they go. Thus they support economic growth in the country to which they are attracted but at the same time they temper the rates of advance of earnings and profits and the incentives to introduce new inventions there. It has to be remembered however that immigration creates new demands for goods, both consumer goods and capital goods, at the same time as it increases the supply of productive labour.

Of course labour and capital funds are not, in the real world, mobile in equal degree, nor is one grade of labour necessarily as mobile as another grade. On the whole one has the impression that capital funds are rather more mobile than labour, and that professional and skilled labour is more mobile than unskilled. Conditions change from time to time and under certain restraints or artificial stimuli capital or labour may flow "uphill" toward areas of lower marginal returns. The international movements of resources are, even more than domestic movements, deeply affected by governmental policies—immigration, taxation and the like—and by broader political considerations. Thus one would be foolhardy to attempt to make too much of purely economic tendencies to equilibrium. But the tendencies

are there. Capital and labour have both flowed to Canada in response to the extraordinary demand, domestic and foreign, for our products. These have supported the rise in our output and output per head in recent times as in earlier times.

We need not belabour the point. It is manifest that if savings and workers can distribute themselves according to relative rates of return the rates of growth of output in each country can be adapted more closely to the technical conditions of production and the changes in tastes in each country. But again, this is not to argue that rates of growth of real output will be equal as between countries in equilibrium; it is only to argue that they will reflect differences in tastes and techniques and the developments of these.

But this brings us to our last group of comments on the subject of the international exchange of ideas. We have been overly ambitious relative to our time and talents already and we are not going to undertake a superficial analysis of the international spread of culture. We do wish to make one point very strongly however, even though we have to assert it rather than argue it. The point is this. The greater the extent to which countries hold tastes and technical knowledge in common, the greater is the likelihood that, with international mobility of goods, persons and capital funds between them, they will exhibit rates of growth of real income per head of about the same order of magnitude. International trade in ideas operates at both extremes of the economic structure; it operates to blur the differences in tastes and to blur the differences in the institutions and technology that contribute to the satisfaction of those tastes. If the movements of factors and goods adapt national rates of growth of output to each other to the extent warranted by differences in tastes and techniques and if movements of ideas reduce differences in tastes and techniques, free or even fairly free international trade will tend to reduce differences in rates of growth of output. Certainly judging from such information as we have, the difference between the average discrepancy among rates of growth of Western nations and the average discrepancy among rates of growth of underdeveloped nations is not inconsistent with this assertion. Certainly also, to bring the matter more to focus upon the Canadian scene, the marked similarity between the rates of growth of output per head in Canada and in the United States is not inconsistent with this theme.

Up to this point we have not made any mention of the effects of differences in the size of nations in our discussion of the effects of international trade in regulating differences among rates of growth. This has been mainly because, in our view, considerations of size become most important when the discussion reaches the level of examining the effects of exchanges of ideas. The influence of the larger country is likely to be decisive in the realm of trade in ideas. It is in the larger country that the large research establish-

ments will most likely be found and from which the greatest stream of improvements in engineering and technical knowledge, both dramatic and otherwise, would be expected to flow. Moreover, the emulation of the tastes and institutions of the larger country by the smaller is apt to be greater than the emulation of those of the smaller by the larger. As a general proposition this is of course debatable and in any event we would not argue that no technological advances or independence of tastes and institutions should be expected in the smaller country. It will not be denied however, that Canada has in an earlier period depended on the United Kingdom and in more recent times on the United States, in both cases very heavily, for the new technological knowledge she has applied, for patterns for her institutions and for standards in allocating time between leisure and work and in allocating income among goods and services.

We conclude from this brief survey of international economic relations that there are forces binding national rates of growth of real income in equilibrium, that rates of growth will reflect, in a broad way, differences in tastes, institutions and techniques, and that trade in ideas is a powerful agent in reducing differences among nations in the basic determinants of growth and consequently in rates of growth. Specifically we would expect that the difference between the rates or growth of the Canadian economy and the American economy would continue to be small and that Canada will continue to be a very heavy importer from the United States not only of goods and services but also of ideas that do not enter the balance of payments—ideas concerning methods of production and methods of organization and ideas of what to consume.

6. *Summary of Part II*

In this part we have, as it were, stood a long way back from our data, noted that at that distance the general impression gained was of fairly straight lines either level or rising, and raised the question as to the necessary relations among such trends when an economy is in long-run equilibrium. We have proved nothing. A severe critic could argue that we should not be too surprised at the regularities implied by our models in the light of the regularities built into them. The critic would be right, yet we would reject the criticism, for our object has been precisely to deduce the regularities implied in our assumptions.

In the single-industry case, on the assumptions that the rate of growth of the labour force (or man-hours of labour input) is a given constant, that the so-called innovation factor governing the adoption of neutral innovations grows at a given constant rate, that saving and investment are a constant proportion of output and that the input-output relation is such that in a competitive economy the shares of labour and capital in output are constant, we deduced among other things that, after a period of adjustment, output,

capital, additions to the stock of capital, consumption and saving would all grow at the same constant rate. We also deduced that the ratio of capital to output would be constant and that the productivity of labour (output per unit of labour input) would rise at a constant rate, the same rate indeed as that at which the ratio of capital to labour input would rise. In the models involving more than one industry we emphasized that competitive buying and selling induce a mutual adjustment of the rates at which innovations are introduced in the various industries. In streamlining the assumptions and analysis we paid, it will be granted, more attention to competition in the markets for factors than in the markets for products. While we continued to assume that the rate of technical progress was given we were forced by the analysis to argue that it could not be independently given for all industries. In the three-industry model we discussed how industries producing a declining share of output employ a declining share of the economy's supply of labour and capital although continuing to introduce innovations at a rate consistent with rates in other industries. In a few paragraphs on government receipts and expenditures we commented on the effects on capital accumulation of the diversion of funds through the government. In a final section on international aspects of the subject we argued that mobility of goods and resources prompted by competition operates with the international spread of ideas to promote similarity among national rates of growth of output per head.

Our object has been to *illustrate* two key notions. The first of these key notions is that in a broad way the economic system in the long run is stable and moves toward equilibrium in which the rates of advance of its various components are bound together by the movement of buyers and sellers in quest of gain. This idea of the price system as the essential linking mechanism of the growing economy is a venerable one and about as old as economics itself. The second key idea that we have sought to illustrate is that fairly simple economic models, reflecting the feature of the price system described and with plausible assumptions respecting the growth of exogenous variables imply equilibrium movements of output, capital, investment, saving and consumption that are consistent with impressions of the data gained when standing some distance back from the charts displaying their movements over a long period. But we do not wish to make excessive claims for this theoretical exercise. It has been presented as a means of conveying the sort of philosophy with which we approach our forecasting problems. Whether the view is a helpful one must in the end be judged by the relation of the forecasts to the experience that will be recorded by 1980.

III. *Fluctuations and Growth*

If one gains the impression when standing well back from his charts that the measures of economic activity progress smoothly and simply, one quickly loses this impression if he stands closer to his data, for closer inspec-

tion reveals that economic time series display complex movements, some fairly regular and cyclical in character, others jerky and apparently random in character. We have argued before that trend lines essentially are summaries of the data, complicated averages as it were, made by the analyst to assist him in discovering patterns amid complexities. But the economy does not move along smooth trend lines—it moves around them. It is the essence of our position that in the short run, speaking rather figuratively, the economy is essentially unstable, but that it is stable in the long run.

In this part we shall concentrate on developing this theme with particular reference to the fluctuations in economic activity having a period of two to ten years often referred to as the business cycle.[47] We shall not concern ourselves with the essentially random movements in the time series, nor with the short, though more regular, movements that might be associated with the progression of the seasons. We note that cycles having a period substantially greater than ten years may also be reflected in some data, but they will not be the focus of our attention. It will be obvious that we owe a very great deal to the work of the late J. A. Schumpeter[48] and to the development of it in the post-Keynesian period by such writers as N. Kaldor[49], M. Kalecki[50], R. M. Goodwin[51] and R. C. O. Matthews.[52]

In summary the argument will be (a) that progress, especially through the introduction of innovations and capital formation is made in bursts associated with the business booms reflected in our data, (b) that the business cycle is an alternating sequence of booms and recessions in which, characteristically, entrepreneurs collectively overestimate and underestimate their economic opportunities, (c) that the overriding pressures exerted over the longer run, essentially by the price system operating through the agency of profit-seeking entrepreneurs in particular and calculating buyers and sellers generally, keep the unstable short-run movements within bounds, and (d) that the average rate of advance of the economy expressed in the slopes of trend lines (pertaining to output, output per capita, and so forth) will be the more rapid, the more optimistically and vigorously entrepreneurs react to improvements in prospective profits.

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[47] We wish to use the term "business cycle" without thereby implying that in the data there is pronounced regularity of fluctuations either with respect to their period or their amplitude.

[48] *Business Cycles*, Vols. I and II, New York, 1939.

[49] "A Model of the Trade Cycle", *Economic Journal*, Vol. L, 1940, pp. 78-92.

"The Relation of Economic Growth and Cyclical Fluctuations", *Economic Journal*, Vol. LXIV, 1954, pp. 53-71.

[50] *Theory of Economic Dynamics*, London, 1954.

[51] "The Non-linear Accelerator and the Persistence of Business Cycles", *Econometrica*, Vol. 19, No. 1, June, 1951, pp. 1-17.

"The Problem of Trend and Cycles", *The Yorkshire Bulletin of Economic and Social Research*, 1953, pp. 89-97.

"A Model of Cyclical Growth" in *The Business Cycle in the Postwar World*, ed. by E. Lundberg, London, 1955, pp. 203-221.

"Econometrics in Business Cyclical Analysis", Chap. 22, in *Business Cycles and National Income*, by Alvin H. Hansen, New York, 1951.

[52] "The Saving Function and the Problem of Trends and Cycles", *The Review of Economic Studies*, Vol. XXII (2), 1954-55, pp. 75-95.

"Capital Stock Adjustment Theories of the Trade Cycle and the Problem of Policy" in *Post-Keynesian Economics*, ed. by K. K. Kurihara, 1954, pp. 180-183.

We shall discuss first some features of economic fluctuations in a static economy (in which population growth and capital accumulation are zero and in which there are no changes in tastes, institutions and techniques). Then we shall discuss the consequences of changes from cycle to cycle in technology, population and the stock of capital. This division of the discussion is made solely for convenience in exposition and not because we wish to leave the impression that the theory of fluctuations in a static economy is immediately relevant. We must again remind the reader that the analysis will be incomplete—suggestive but not exhaustive. In particular the analysis will relate to a closed economy. Some aspects of the international features of fluctuations of economic activity in Canada are discussed however in another of the Commission's studies, namely *Canada-United States Economic Relations*.

The fluctuations in economic activity have been noted by students and analyzed for centuries. There is no universal agreement today on their character and explanation—indeed the very character of the fluctuations has no doubt been modified by changes in institutions and practices over succeeding generations. One cannot therefore afford to be dogmatic in any discussion of the matter. In the last two or three decades, however, divergencies of view seem to have diminished and some concensus to have emerged as to features that must have prominence in any account. What follows is little more than an abbreviated report on recent literature of the subject.

In most of the recent literature there is considerable stress on the mutual relations among saving, investment, the stock of capital and output. It is therefore on these variables that we shall concentrate our attention. Let us consider first the factors governing current investment intentions.

Investment intentions we take to be governed by many considerations, but of these the expected rate of profit on capital is surely the one of overriding importance, at least in the business sector of the economy,[53] and will here be taken to be the governing variable. The expected rate of profit we may suppose to depend on the current rate, which, in turn, will depend on profit per unit of output and the capital-output ratio, where output and capital are taken to be business output and business capital. If profit per unit of output (the profit margin) were constant, it is clear (since in an obvious notation $P/K = P/O \div K/O$) that the rate of profit on capital would vary inversely with the capital-output ratio, that is inversely with the stock of capital and directly with the flow of output. Only if profit margins vary inversely with and in greater proportion than the capital-output ratio would the profit rate not vary inversely with the capital-output ratio. There is evidence that profit margins and the capital-output ratio move in opposite directions during succeeding phases of the business cycle, but the relative movements of the former are typically smaller than those of the latter. We

[53]In marginal terms this is the marginal efficiency of capital that Fisher, Keynes and many analysts have accorded prominent place among the determinants of investment intentions.

shall therefore take it as given that the rate of profit on capital varies inversely with the capital-output ratio.

Considering the matter *a priori,* how would one expect the capital-output ratio to vary with output over the course of the business cycle? It is clear that the rate of change of output should exceed that of the stock of capital; thus when output is rising we should expect the capital-output ratio to be falling and conversely. Perhaps we may speculate further as follows. During the early phases of an upswing it is conceivable that the stock of capital may rise very slowly indeed, relatively to ouput. This is partly because of the time lag between the initiation of capital projects and their completion and partly because the existence of some excess capacity in the economy may delay the initiation of capital projects on a broad front. Later however we would expect the capital stock to increase more rapidly relatively to output. Thus we should expect the capital-output ratio to fall more rapidly relatively to output at the beginning of an upswing than toward the end. During the early phases of a downswing in output it is to be expected that the stock of capital will continue to rise both because of the delay in completing projects begun during the boom and because net investment is not likely to cease entirely immediately that output declines. Thus with the onset of the slump the capital-output ratio would be expected to rise rapidly relatively to output but as the decline continues, and net investment diminishes or even becomes negative, its rate of rise should diminish considerably. The schematic diagram (Diagram 3. 2) will perhaps illustrate this argument. The (negative) rate

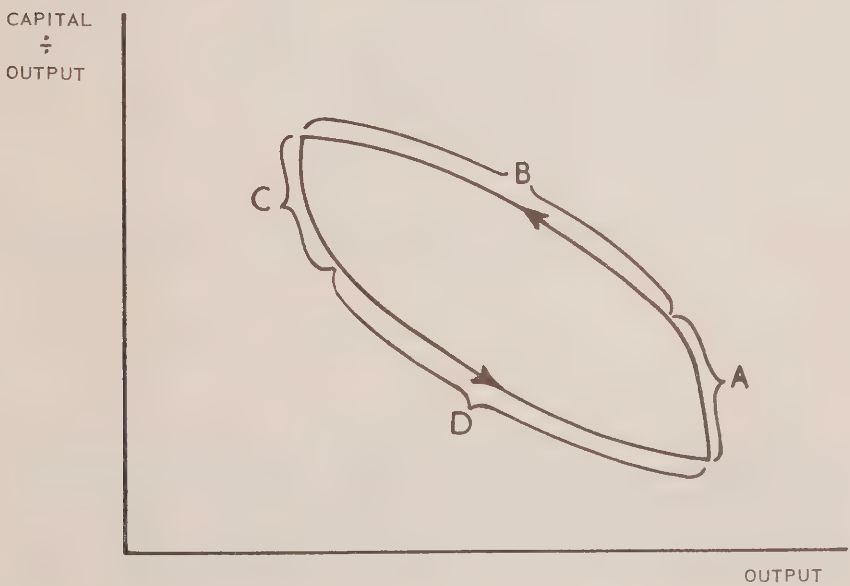


Diagram 3.2

of change of the capital-output ratio with respect to output should be large during the beginning of both the upswing and downswing (parts A and C in the diagram) and relatively smaller during the latter parts of both the upswing and downswing (parts B and D in the diagram).

According to our hypothesis stated above to the effect that the current rate of profit varies inversely with the capital-output ratio, we should expect, in the light of the argument just given, that the profit rate would rise rapidly, relatively to output during the beginning of an upswing, then less rapidly and during the downswing fall rapidly at first and then less rapidly, again with respect to output. This relationship is shown in Diagram 3. 3.

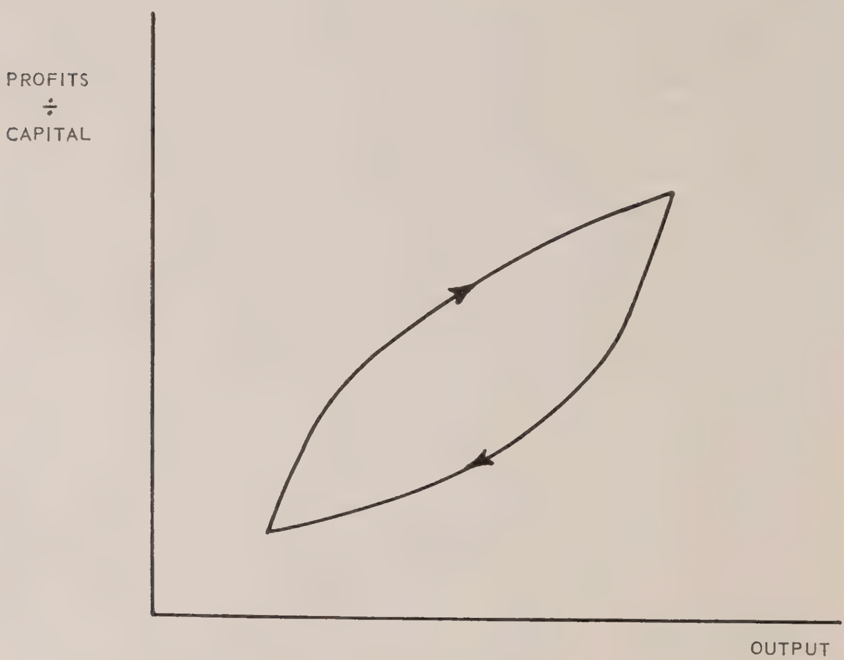


Diagram 3.3

Expected profit rates would also vary in this way if these were always directly proportional to current profit rates. Such a close tie is not likely to be found however. Other factors undoubtedly will also contribute to the formation of expectations. For example, as the upswing progresses, rises in costs of labour, materials, and borrowed money may have the effect of tempering expectations of profits and, if memories are not too short, the very

progress of the boom may stir apprehension in some key quarters. Similarly in the downswing, prices of some of the factors of production may fall fairly readily, but others, more inflexible because of their contractual character or for other reasons, will come down more slowly but in coming down may enhance expectations of profits. Again, long memories may offer progressively more encouragement to entrepreneurs as the downswing progresses.

We have argued thus far that investment intentions are governed primarily by the expected rate of profit, which in turn, though affected by many considerations, tends to vary inversely with the capital-output ratio. It will be convenient for exposition to translate this argument into slightly different terms and, following Kaldor, to present it in a diagram that will be familiar to some readers and that we may continue to use and modify as the analyis is developed. Our hypothesis that investment intentions vary inversely with the capital-output ratio implies that investment intentions vary directly with output and inversely with the stock of capital. In this latter form the proposition may be depicted in two dimensions as in Diagram 3. 4 in which we

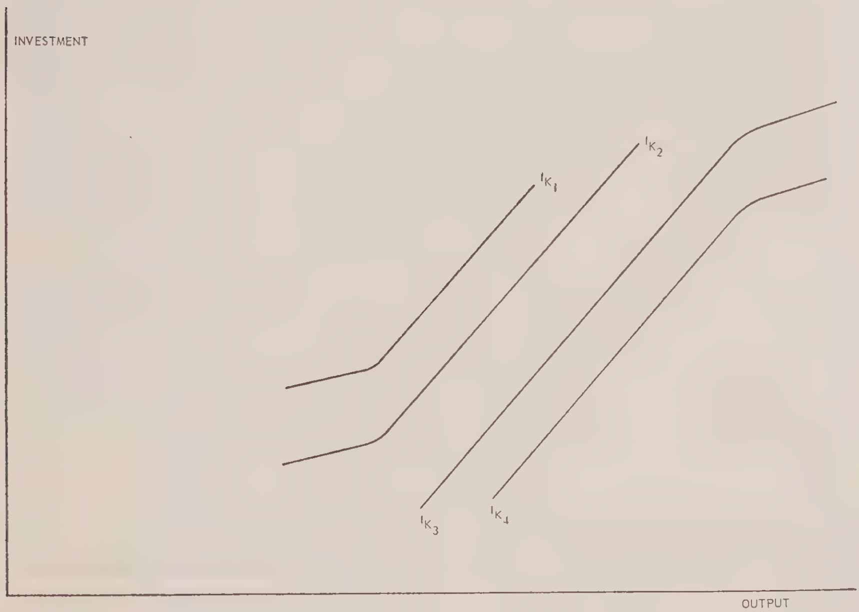


Diagram 3.4

measure the dollar value of the amounts of investment expenditure that entrepreneurs intend to undertake at any level of output on the vertical axis, and the dollar value of output on the horizontal axis. The relation between investment intentions and output that pertains to any level of the stock of capital is shown by a curve on the diagram such as that labelled $^{I}K_1$. We

must imagine a whole family of such curves (technically an infinite number of them), one for each possible stock of capital; we have depicted only a few and labelled them with symbols ${}^{I}K_1$, ${}^{I}K_2$, ${}^{I}K_3$ and ${}^{I}K_4$ representing successively larger amounts of capital. Let us explain more fully how the diagram depicts the effects of the factors governing investment intentions. In the first place if we consider any level of output and read off the ordinates to the curves in relation to the symbols denoting the stock of capital to which each pertains, we see that investment intentions are represented as varying inversely with the stock of capital. Then, if we concentrate our attention on any one of the curves (that is, consider any particular stock of capital) and read off the ordinates to that curve moving from left to right, we see that investment intentions are represented as varying directly with the level of output. Factors such as changing costs and memories of past recessions and recoveries that may be thought to influence expectations of profit rates and hence investment intentions are reflected by the particular shapes given to the individual curves. The curves pertaining to lower stocks of capital are the ones relevant when the economy is in the latter part of the downswing or the early part of the upswing, and the flattening of the curves at the extreme left we interpret as reflecting the course that investment intentions would take when output is low if the stock of capital were constant. Specifically it is supposed that with a given stock of capital the decline in investment intentions associated with falling output diminishes as output falls below some value or range of values, and that in the early part of the upswing with constant stocks of capital the restoration of confidence would be gradual at first and then more rapid so that the rate of change of investment intentions with respect to output would be gradual at the beginning of the upswing and then more rapid after output had broken through a certain value or range of values. The curves pertaining to higher stocks of capital are the ones relevant when the economy is in the latter part of the upswing and the early part of the downswing and the flattening of these curves at the extreme right we interpret as reflecting the course that investment intentions would take when output is high if the stock of capital were constant.

Specifically it is supposed that with a given stock of capital the rise in investment intentions associated with rising output diminishes as output rises above some value or range of values and that in the early part of the downswing with constant stocks of capital the destruction of confidence would be gradual at first, but more rapid after output had broken through a certain value or range of values. For simplicity we have related investment intentions to the level of output alone rather than to both the level and direction of change of output. The latter is perhaps a more fruitful hypothesis, but it greatly complicates the diagrammatic exposition. In the diagrams that follow we have left undefined the irrelevant upper (lower) reaches of the investment curves that pertain to low (high) stocks of capital. It must be emphasized

that we do not trace the path of investment intentions over the course of the full cycle of output along any one curve as the relevant curve shifts as the stock of capital changes over the course of the cycle. This path of investment intentions over the cycle is indicated in Diagram 3. 6 and appears, as we would expect, essentially like the variation of the profit rate with respect to output shown in Diagram 3. 3. We shall discuss the course of investment intentions over the cycle further after we have introduced two further relations, namely the relation of replacement investment to output and the relation of saving to output. Let us introduce these relations now.

In the situation under discussion in which there is no growth in the stock of capital from cycle to cycle, the average amount of replacement required to maintain the stock of capital during the cycle will be the same in each successive cycle. (In this statement we have clearly abstracted not only from secular growth in the stock of capital but also from secular changes in its composition.) The distribution of required replacement within the cycle will not likely be very uneven. If the service life of capital were quite inelastic, one could imagine special situations in which replacement would all be concentrated in the upswing of the cycle,[54] but these are special situations. Generally speaking the service lives of equipment and structures show considerable variability. In view of the consideration that during the boom when capital is especially scarce it may be worked rather more intensively than at other times, we shall assume that required replacement rises very modestly with respect to income. The relationship is depicted as the line RR on Diagram 3. 6.

Intended saving like intended investment we shall assume to vary directly with output and inversely with the stock of capital, but, with certain exceptions to be noted below, we shall also assume that the rate of change of saving is less than the rate of change of investment with respect both to output and to capital. Except when the contrary is explicitly stated governments are presumed to balance their budgets so that, since we are considering a closed economy at this point, all saving is done either by persons or by business. Personal saving, it is supposed, varies directly with personal income while gross business saving varies directly with business income and inversely with the capital assets of business. With the exceedingly modest degree of refinement of this analysis it will be sufficient to consider income in both cases to be defined as income before taxes, and when we think of gross saving for the economy as a whole we will identify the income variables with output. Similarly, when considering gross saving for the economy as a whole we will identify the capital variable with the total stock of capital controlled by business.

[54]See for example J. Black, "A Note on Mr. Kaldor's Trade Cycle Model", *Oxford Economic Papers*, Vol. 8, 1956, pp. 151-163 and N. Kaldor, "The Relation of Economic Growth and Economic Fluctuations", especially pp. 58-60.

As has been noted earlier in this study recent research into patterns of personal saving has emphasized repeatedly the difference between the degree and direction of variation of the ratio of saving to income indicated by long-run data for growing economies and shorter-run data relating to the upswing or downswing of cycles. In general what has been found is that over the long run, saving increases virtually proportionately with income whereas in the shorter run, over the upswing or the downswing of cycles, saving varies proportionately more than income. Several hypotheses have been advanced to account for this[55] and some are variants of the same theme. We cannot enter into a detailed discussion of the matter here. We shall suppose, however, in broad consistency with these views, that over the cycle, in an economy with no progress, personal saving varies directly with but proportionately more than personal income. More technically we shall assume that during both the upswing and the downswing of the cycle the marginal propensity to save exceeds the average propensity.[56]

Since personal saving is the difference between personal income and current expenditure on consumer goods by persons, the hypothesis we have just stated implies that consumer expenditures are less sensitive to changes in personal income, indeed that consumer expenditures vary directly with but proportionately less than current income. This is the proposition to which one is led by theories of consumer behaviour like those of the authors cited that place great weight on consumer wealth or past incomes as determinants of current consumer expenditure on goods and services and that regard savings or a large part of savings as a residual. Over the cycle, changes in unemployment are a principal cause of the changes in income of persons. If the changes in employment affected the incomes of all persons in equal degree and if all saving could be regarded as the residual portion of income after expenditures on consumer goods according to the standards of consumption enjoyed when income was at its highest previous level, then the explanation of the hypothesis that personal saving, over the cycle, varies proportionately more than personal income would be straightforward. But while we wish deliberately to avoid detailed exposition, we must record the following qualifications or amplifications of the hypothesis.

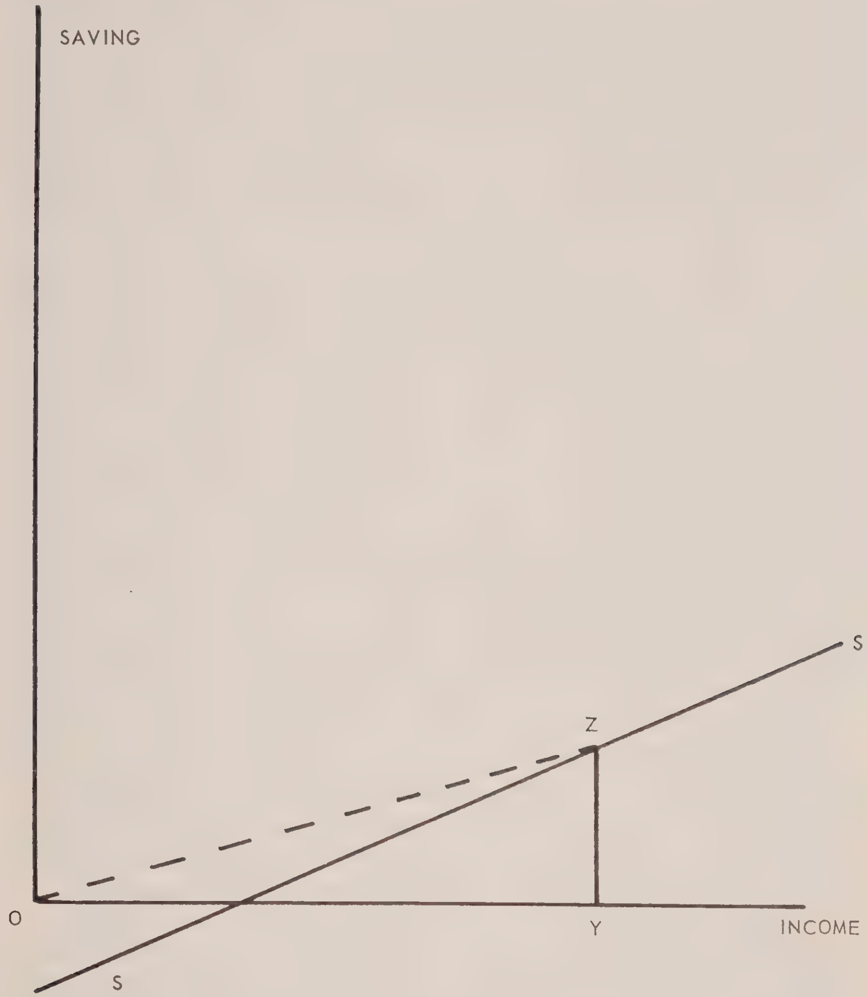
In the first place, during a downswing not every worker suffers a loss of wages or salaries. The totally unemployed are the principal losers. Some will be partially employed and suffer losses of income on that account; others will be fully employed but will suffer cuts in rates of pay, while still

[55]We refer here only to F. Modigliani, "Fluctuations in the Saving-Income Ratio", *Studies in Income and Wealth*, National Bureau of Economic Research, Vol. 11, New York, 1949, pp. 371-443; J. S. Duesenberry, *Income, Saving and the Theory of Consumer Behaviour*, Cambridge, Mass., 1949, pp. 69-92 and 114-116; M. Friedman, *A Theory of the Consumption Function*, to be published by the National Bureau of Economic Research; and R. C. O. Matthews, "The Saving Function and the Problem of Trend and Cycle", *op. cit.*

[56]The marginal propensity to save is the ratio of an increment in saving to the corresponding increment in income, that is the slope of the saving-income relation, SS, in the attached diagram. The average propensity to save is the ratio of total saving to total income. In the diagram, at income Y and saving level YZ, the average propensity to save is equal to the slope of the line OZ.

See following page for diagram to this footnote.

DIAGRAM TO FOOTNOTE 56



others will neither lose opportunity to work nor suffer cuts in rates of remuneration. The relative importance of each of these groups in a downswing will depend on the severity and duration of the decline in activity. Moreover, even those who are totally unemployed may receive some compensation through unemployment insurance or measures of relief. We shall return to this point later in the discussion of cycles in the context of economic growth.

Not all personal income is comprised of wages and salaries; perhaps two-thirds consists of wages and salaries (depending on the precise definitions of "persons" and "income" used), the rest is made up of investment income or imputed income of one kind or another. The separation of the income and saving of entrepreneurs of unincorporated business into that related to the business and that related to the household, as it were, is exceedingly difficult conceptually and is probably not clearly made, in a large proportion of the instances, by the persons involved. Thus the concession has to be made that the blurring of the distinction between persons and unincorporated business will inevitably blur the analysis both of personal saving and business saving.[57]

The definition of income and saving is rendered difficult by the problem of distinguishing persons as members of households and persons as members of unincorporated business firms; it is rendered difficult by other considerations as well. Should expenditure on durable goods such as residential houses, automobiles, refrigerators, television sets and the like be considered as consumer expenditure or as the disposition of consumer saving? If purchases of such durable goods are considered part of personal saving, should imputed income from them be included in personal income and imputed rents on them be included in consumer expenditure? If imputed rents are included in income and expenditure, should these rents include or exclude depreciation on the items and if so how should the depreciation be calculated? The answers to these questions depend in part on the purposes of the analysis in hand and we shall not enter into a discussion of the matters involved.[58] We wish to make one point only, namely that current expenditure on new consumer durables is likely to be very much more volatile, that is, sensitive to fluctuations in personal income, than other consumer expenditures so that the slope of the (short-run) saving-income relation pertaining to the upswing and downswing of a cycle is likely to be steeper if expenditures on durables are included in saving than if they are included among expenditures on other consumer goods and services.

Finally, we must draw attention to the significant and increasing role of contractual saving in total personal saving however defined. Contractual saving takes a variety of forms but particularly it arises from contracts for life insurance, annuities and pensions and from mortgages and other contracts related to delayed payments for consumer goods and services pur-

[57]On this, and the remaining two qualifications we are about to make, the reader is referred to the papers by James N. Morgan, "The Structure of Aggregate Personal Saving", in the *Journal of Political Economy*, Vol. LIX, 1951, pp. 528-534 and Vol. LXI, 1953, p. 536.

[58]Alternative definitions of saving and income are discussed extensively in the monumental works by Goldsmith and others to which the reader is referred for information on saving generally, namely *A Study of Saving in the United States*, Princeton, N.J.

Volume I, Introduction; Tables of Annual Estimates of Saving 1897 to 1949, by Raymond W. Goldsmith, 1955.

Volume II, Nature and Derivation of Annual Estimates of Saving 1897 to 1949, by Raymond W. Goldsmith, 1955.

Volume III, Special Studies, by Raymond W. Goldsmith, Dorothy S. Brady and Horst Mendershausen, 1956.

chased. Contractual saving may easily be increased with an increase in income but the costs involved, and other considerations, make it relatively insensitive to decreases in income. If contractual saving were a large proportion of total saving it would be expected to affect the slope of the short-run saving-income relation, but the nature of the effect would depend on the character of the contractual saving. If it were predominantly made up of saving through insurance, annuity and pension contracts, then, inasmuch as the tendency to enter into such contracts and the annual payments associated with them are relatively insensitive to income changes, one would expect the slope of the saving-income relation to be lower than in an economy in which this type of contractual saving was much less important. But if contractual saving were the predominant form of saving and if it were made up largely of payments related to earlier purchases of durables including houses, then, since the tendency to purchase durables is sensitive to income changes and would be rendered more so by the available credit facilities in the boom and the pressure of debts in the downswing, one would expect the saving-income relation to be steeper than in the case just described and than in the case in which contractual saving was not on the average a large proportion of total saving.

Gross saving by business is made up of depreciation allowances and other retained earnings. In the stationary economy under discussion in which the stock of capital is the same at (say) the peak of each cycle, depreciation allowances required over the cycle will be constant. However, their distribution over the cycle would not be even, rather they would likely be higher when the stock of capital is higher, namely in the boom phase of the cycle. Thus so far as depreciation allowances are concerned we would expect gross business saving to vary directly with the stock of capital.

Retained earnings or net business saving are the part of earnings (after expenses including depreciation) that are left in the firm after dividends are paid out. We shall argue that in business and in particular in corporations, there prevails a view of a normal ratio of distributed profits to net worth (which may well differ from firm to firm or from industry to industry). If profits rise relatively to net worth, we would expect retained earnings to rise proportionately more than total earnings. Conversely, if profits fall relatively to net worth, we would expect retained profits to fall proportionately less than total profits. Thus, on this analysis we would expect retained earnings to vary directly with business income (after expenses) and inversely with the net worth of business.[59]

An alternative way of expressing the same general relationship that is preferred by some lays stress on the conservatism of corporations in the matter of changing the rate of dividends per share. Professor Lintner, for

[59]S. P. Dobrovolsky provides qualified corroboration of this view in his *Corporate Income Retention*, National Bureau of Economic Research, New York, 1951. See also the discussion of this work in R. C. O. Matthews, "The Saving Function and the Problem of Trend and Cycle".

example, contends that the existing rate of dividends per share is the key variable consciously entering into decisions concerning allocation of profits after taxes by corporations. He further argues that the corporations are conservative about changing this rate and even when decisions to change it are taken and new standard rates are chosen, they are usually interpreted as targets to be approached more or less gradually. Now if the number of shares outstanding increases[60] at the same rate as net worth then if dividends are paid at a given rate per share, the ratio of dividends paid to net worth will be constant. If the rate of increase in the number of shares outstanding is less than that of net worth, as seems likely, dividend payments will rise proportionately less than net worth and hence less than total profits, which if anything go up more rapidly than net worth. But if in such a situation there is a more or less gradual adjustment of the standard rate of dividends per share, the ratio of payments to net worth will vary less.[61]

We must now combine the hypotheses concerning depreciation allowances and other retained earnings. It will simplify matters greatly if we substitute the stock of real capital for net worth in the hypothesis concerning retained earnings. The further justification for this is that business net worth and the stock of real capital may be expected to rise and fall together though not necessarily at the same rates. With this substitution we contend that a change in the stock of capital, income changes aside, is associated with a change of depreciation allowances in the same direction and a change of retained earnings in the opposite direction. Which effect may be expected to predominate? One cannot be certain but evidence has been cited to show that the marginal propensity of corporations to save exceeds the average propensity whether saving and profit are measured gross or net, and this implies that the effect of changes in capital stock on depreciation allowances is outweighed by its effect on retained earnings.[62] This much is certain, namely, that the offsetting effects will diminish the responsiveness of business saving and hence total saving to changes in the stock of capital. This is a point to which we shall revert below.

We may now summarize and combine our hypotheses concerning saving. We have proposed that personal saving varies directly with personal income and that business saving varies directly with business income and inversely with the stock of capital controlled by business. Since both personal income

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[60]Obviously changes in "number of shares outstanding" must be interpreted carefully as usually shares are of several classes and kinds; in particular, changes in number resulting from "stock splits" require an automatic redefinition of the standard rate of dividends per share.

[61]Professor John Lintner in his "Distribution of Incomes of Corporations Among Dividends, Retained Earnings and Taxes", *American Economic Review, Papers and Proceedings*, May, 1956, pp. 97-113, prefers this latter way of expressing the hypothesis and emphasizes the conservative attitude toward changes in the dividends per share ratio rather than that toward changes in the dividends-net worth ratio. His preference is based on his own field work designed to discover what variables consciously are considered in the decision-making process and on statistical (regression) analysis of dividend payments. We shall express our hypotheses in terms of the ratio of dividend payments to net worth largely for simplicity in our exposition, but also in the firm belief that the compatibility of the two formulations of the hypothesis is not denied by the evidence we have examined.

[62]The data in this field for any country are still unsatisfactory and one puts forth arguments with great diffidence. In this particular matter we are following R. C. O. Matthews, "The Saving Function and the Problem of Trend and Cycle", *op. cit.*, especially p. 86.

and business income may be expected to vary directly with national output we shall simplify the statement of our combined hypothesis. We conclude that total intended saving in the economy varies directly with output and inversely with the stock of real capital owned by business.[63] This relationship is portrayed in Diagram 3. 5 in which intended saving is measured on the vertical axis and output on the horizontal axis. For each stock of capital the single upward sloping line depicts the increase of intended saving with output. Each line in the family is labelled with an index to indicate the stock of capital to which it pertains; K_1 is to be regarded as less than K_2 and K_2 less than K_3, etc. If we start from any point on the output axis and move vertically through the diagram we intersect lines with progressively lower indexes; this reflects the inverse relationship between intended saving and the stock of capital.

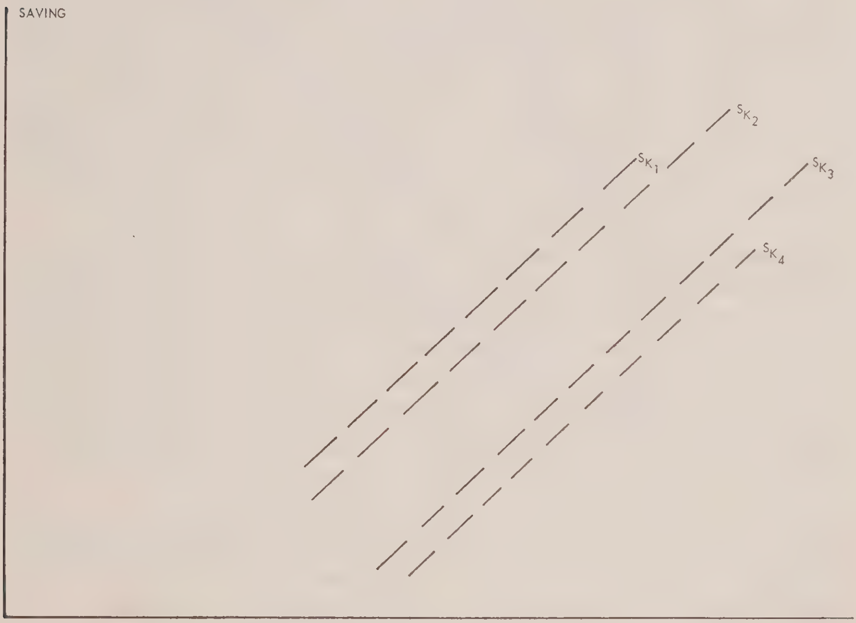


Diagram 3.5

We have now almost completed the description of our assumptions concerning the interrelations among intended gross saving, intended gross investment, replacement expenditures, output and the stock of capital. Let us combine the representations of the assumptions we have made. In diagram 3. 6 the family of investment-output curves is shown by the solid lines rising from left to right and labelled $^{I}K_1$, $^{I}K_2$, etc. The family of saving-

[63]Part of the stock of capital is owned by persons and its acquisition is financed out of personal saving (if persons are not net borrowers from business); another part is owned and controlled by government. Reference to government investment will be made later.

output curves is shown by the broken lines rising from left to right and labelled ${}^{S}K_1$, ${}^{S}K_2$, etc.[64] Required replacement expenditures are indicated by the ordinates to the dotted line labelled RR.

There are some features of the relations between the lines in the diagram that reflect assumptions that have not yet been made specific. In the first place, if we compare the slope of the saving curve ${}^{S}K_2$ with the investment curve ${}^{I}K_2$, we note that in the middle ranges of output the slope of the investment curve has been made steeper than the slope of the saving curve. This implies in other language that we assume that the marginal propensity to invest exceeds the marginal propensity to save in these ranges of output. These are the ranges of output that will be traversed during the middle of the upswing and the downswing of the cycle. Our assumption, therefore, amounts to this, that during the upswing and during the downswing of the cycle intended investment responds more to a given increase or decrease in output than intended saving. However, it will be noted that at the extremes of the range of output the slope of the investment line is less than the slope of the saving line. This reflects the assumption we have made concerning the dependence of investment intentions on the rate of profit and the variation of the rate of profit with income and capital.

The second feature of the relationship of the curves to which we must draw attention immediately is that the rate of change of saving with respect to capital is shown as being smaller than the rate of change of investment with respect to capital, particularly at the extremes of the range of variation of the stock of capital. The vertical distance between the ${}^{I}K_1$ line and the ${}^{I}K_2$ line is always greater than that between the ${}^{S}K_1$ line and the ${}^{S}K_2$ line. Similarly, the vertical distance between the ${}^{I}K_4$ line and the ${}^{I}K_3$ line is always greater than the vertical distance between the ${}^{S}K_4$ and the ${}^{S}K_3$ lines. This is in part the result of the offsetting effects of changes in the stock of capital on depreciation allowances and retained earnings. But the greater sensitivity of investment expenditures both to changes in output (in the middle ranges) and to changes in the stock of capital reflects what we take as a basic proposition, namely, that investment expenditures are the volatile element in the cyclical process.

Let us now trace the path of intended investment, intended saving, output and capital over the course of a typical business cycle. We remind the reader that the discussion is still confined to the case of an economy in which the population and technical knowledge are unchanging and the average stock of capital is constant from one cycle to the next. Consider the situation at the point A in the diagram. At this point we note that

[64]It should be stated explicitly that a higher subscript refers to a larger stock of capital but that we only imply that K_3 greater than K_2 greater than K_1 not that $K_3—K_2=K_2—K_1$.

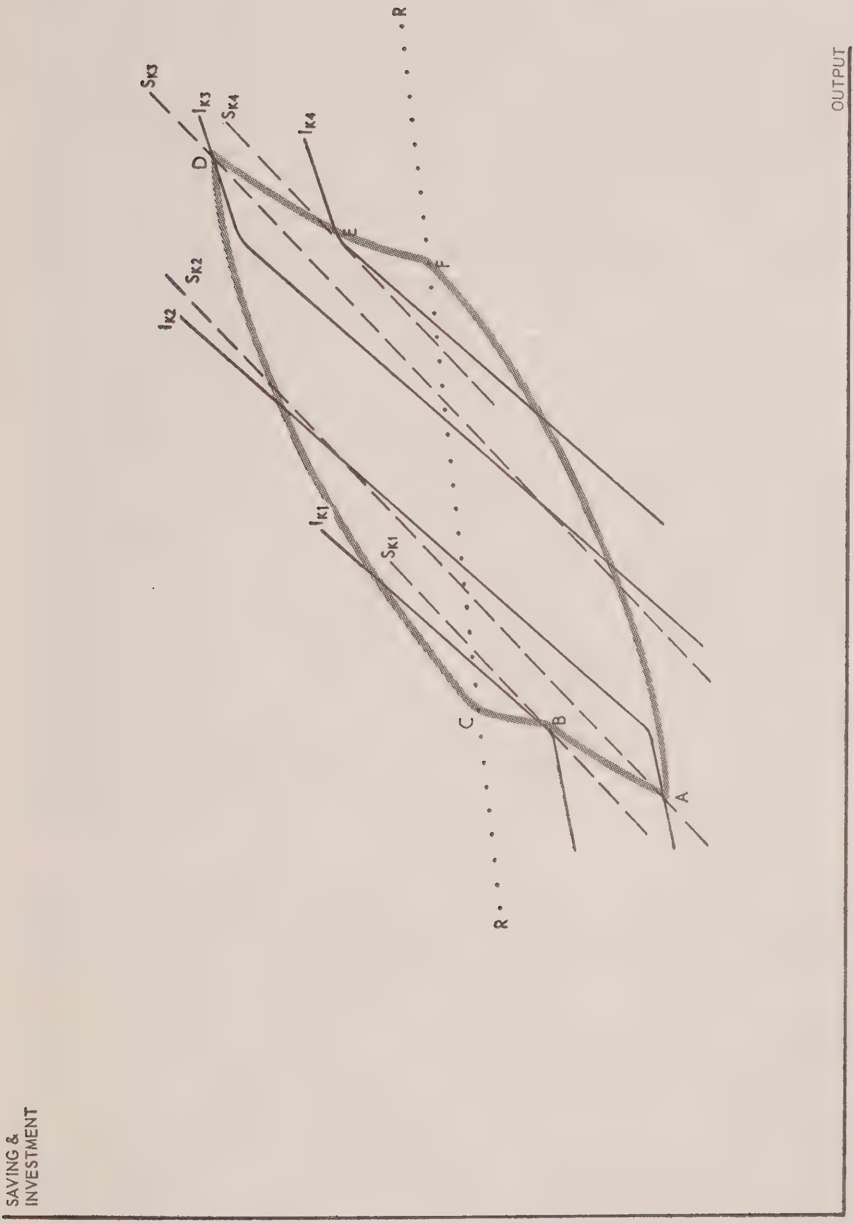

SAVING & INVESTMENT
OUTPUT
R
R
A
B
C
D
E
F
I_{K1}
S_{K1}
I_{K2}
S_{K2}
I_{K3}
S_{K3}
I_{K4}
S_{K4}

Diagram 3.6

intended saving equals intended investment and we might be inclined to think that this was a stable equilibrium position from which the economy would not move up or down. However, it will be noted that the level of intended investment does not provide even for the required replacement expenditures. Thus the stock of capital must be falling from its value at A, namely K_2. However, the fall in the stock of capital tends to raise both intended investment and intended savings (to move the savings and investment curves to the left) and to raise intended investment more than intended saving. This leads to an increase in output. The process continues in this manner, the stock of capital decreasing, intended investment and saving increasing, and thus raising the level of output, until position B is reached. At position B, the relationship of the marginal propensity to save to the marginal propensity to invest reverses and thereafter for a time the latter exceeds the former. This adds to the expansionary pressure in the economy for now, apart from effects of changes in the stock of capital, increases in output serve to increase the intentions to acquire capital goods more rapidly than the intentions to save.[65] Until investment reaches the level of required replacement, both the S and I curves continue to shift to the left and contribute to the effect of output changes in widening the gap between planned investment and planned saving. After the point C is passed, the stock of capital starts to increase (investment exceeds replacement). The marginal propensity to invest remains in excess of the marginal propensity to save. Gradually, however, the increase in capital reduces the desires to save and to invest and the S and I curves shift to the right across the diagram. In this phase of the cycle changes in the stock of capital increasingly serve to diminish the gap between intended investment and saving while increases in output, deriving partly from the increased contribution of capital to the productivity of labour, serve to increase it. Eventually, after the expansion has carried to the point (not delineated on the diagram) where the marginal propensity to invest becomes equal to the marginal propensity to save, changes in output combine with changes in capital in narrowing the expansionary gap between investment and saving. The expansion of output terminates at the point D at which intended investment and intended saving are again equal. But the expansion of the capital stock does not cease at this point since investment continues above replacement requirements. Expected profit rates are reduced, and both the investment and the saving curves continue moving to the right. But now the change in the quantity of capital creates a contractionary gap between savings and investment as desired investment falls sharply so that intended saving exceeds intended investment. Output falls though capital continues to rise. The process con-

[65]It is perhaps desirable to emphasize that rates of change of variables with respect to time are not shown explicitly on the diagram. The only rates of change that are shown are rates of change of one variable with respect to another. Thus if one interprets the shaded path as the path of intended investment, the kink at B does *not* imply that investment intentions increase more slowly with respect to time at the right of B than at the left of B, but rather that investment intentions increase *more* rapidly with respect to *output* at the right of B than at the left of B.

tinues until at point E the relationship of the marginal propensity to save to the marginal propensity to invest again reverses and thereafter changes in output combine with changes in capital in widening the contractionary gap. After point F is passed, however, investment falls below that required for replacement and the stock of capital falls. The S and I curves begin gradually to shift to the left so that in this phase of the downswing changes in the stock of capital counteract the effects of declining output in widening the contractionary gap. Finally the contraction carries to the point (not shown on the diagram) where the slope of the relevant saving line is again equal to the slope of the relevant investment line, and thereafter reductions in output operate with reductions in the stock of capital to diminish the excess of intended saving over intended investment. Finally, output reaches the level corresponding to the point A, the downswing concludes and the cycle is completed.

This is, of course, a somewhat stylized description. The essential feature of the cycle is the variation in expected rates of profit over its course, rising rapidly as the early part of the upswing progresses and then gradually levelling out, only to fall rapidly as the early part of the downswing progresses and gradually level out again. This phenomenon based in part on differences in the rates of change of capital and output is reflected in the varying effects of changes in output and capital on the gap between intended investment and intended saving. There are several non-essential features in the description. It is not essential, for example, that the replacement line should pass above B and below E; it might pass either above or below B and above or below E, though for technical reasons it cannot pass precisely through either of these points.[66] The changes in output corresponding to the distance from A to B, and corresponding to the distance from C to D, could be greater or less than those shown.

The path joining A, B, C, D, E and F may be given more than one interpretation. It may be interpreted, measuring vertically, as the path of intended investment, or as the path of intended saving, or as the path of realized investment and realized saving. It is an elementary proposition in the economics of income generation that if and only if intended investment exceeds intended saving, income will rise, and conversely, if and only if intended saving exceeds intended investment, income will fall. It is also an elementary proposition in this field, derived from the conventional accounting practices used, that realized saving must always equal realized investment whether income is rising or falling or constant. Intentions of either investors or savers must be frustrated during the periods of changes in income. Various evidences of this frustration may be found, such as unex-

[66]For if it did, the economy at B and E would be on "dead centre", as it were, with the propensity to save equal to the propensity to invest and with no changes occurring in the stock of capital to shift these propensities. Such a possibility has a manifestly low probability.

pected changes in inventories and unexpected changes in income or profit—windfall gains and losses.[67]

To this point we have been discussing a rather abstract subject, namely the character of the business cycle in an economy with unchanging population, knowledge of techniques and tastes, and a stock of capital that does not rise from one cyclical peak to the next. Typically, business cycles are observed in growing economies and the object of our exposition is to direct attention to the interrelations of cycles and growth. To this end we now change our assumptions to permit introduction of innovations and growth of population. We assume that population and the available supply of man-hours of labour grow at a constant rate. We further assume that increases in productivity arising from the introduction of innovations occur at a constant rate. However we allow that in the downswing unemployment may develop, so that not all the available supply of man-hours and capital is utilized at all phases of the cycle, and we further allow that changes in the stock of capital over the cycle will also affect the levels and rates of growth of output per man-hour. We recognize that population does not grow at a constant rate and that the rate of increase of productivity attributable to innovations is not constant, but we reserve discussion of changes in these rates of growth until later.

The introduction of these constant rates of growth does not alter the essential character of the cyclical process that we have described. The cycle is still to be explained in terms of the varying effects of differences between the rates of change of output and capital on expected profit rates and on the gap between intended saving and intended investment. But, to put it figuratively, instead of the economy ever circling about fixed average levels of output, employment and capital, it spirals its way upward with the average levels of the indicators of activity ever rising. How does this come about?

[67]A technical comment is added here on the question of initial conditions. Some readers may be curious as to whether the model we have described would, when formalized, lead to a unique set of paths of the variables that would be independent of their initial constellation of values, that is, whether the cyclical path ultimately adopted by any variable would be the same irrespective of its initial, starting value. We candidly confess ignorance here, though of course the question is not susceptible of answer except in relation to a particular formalization. We are confident that a cycle is implied by the model; we are not confident that it is independent of initial conditions. Authors treating models apparently analogous to the one described here have been inclined to assume that the cyclical paths are unique. This is true of Kaldor (see p. 327 of the reprint of his paper "A Model of the Trade Cycle" in *Readings in Business Cycles and National Income* edited by Alvin H. Hansen and Richard V. Clemence, New York, 1953) and Goodwin ("The Non-linear Accelerator and the Persistence of Business Cycles", *Econometrica*, Vol. 19, 1951, pp. 1-17). But R. H. Strotz, J. C. McAnulty and J. B. Naines, Jr. in "Goodwin's Theory of the Business Cycle: An Electro-Analog Solution", *Econometrica*, Vol. 21, 1953, pp. 390-411, show that Goodwin's cycle does not possess a unique "limit cycle", and Shinichi Ichimura (in "Toward a General Non-linear Macrodynamic Theory of Economic Fluctuations" in *Post Keynesian Economics*, New Brunswick, N.J., 1954, edited by Kenneth K. Kurihara) who has examined the question with respect to several examples, shows that mathematically it is very subtle and that in general, detailed study of a particular formalization is necessary to establish whether the cyclical paths have the property of uniqueness.

The question is related to the study of the effects on the economic system of random disturbances. In the study of cycles, random disturbances have, by some, been given a rather prominent role especially by those who, like Kalecki, have assumed that the marginal propensity to save is greater than the marginal propensity to invest at all levels of output. In such models it was necessary to assume either that certain key parameters (such as the marginal propensities) had highly specific values, or that an otherwise damped cycle was perpetuated by the effects of random shocks. With respect to the model we have presented, the question is not whether random shocks will serve to perpetuate the cycle but whether they will shift the cyclical path permanently. But these are technical matters that we cannot explore here.

Let us approach the matter by re-examining in turn the relations of intended investment to output and capital and of intended saving to output and capital, on which we have already relied in describing the cycle.

In the earlier discussion we assumed that intended investment by business would vary directly with the expected rate of return on its capital stock and that this would vary inversely with the capital-output ratio. We shall continue to adhere to this assumption always with the qualification that none of the relations we specify in this theoretical description can be expected to hold exactly in the record of actual experience.

Turning now to the personal saving function we find that the effects of the change in population and productivity are reflected directly. We assumed earlier that personal saving varies directly with income but that over the cycle the marginal propensity to save exceeds the average propensity to save. While still holding to these assumptions we now argue that the effect of increases in population and productivity is to move the personal saving-income relation to the right, that is, to reduce the amount of intended personal saving corresponding to any given level of personal income. Let us look at the matter in the following way. Consider two successive downswings of the cycle. As between the first and the second suppose that there has been an increase in population and an increase in productivity. To produce a given rate of flow of personal income will (if wage rates rise with productivity) require fewer workers in the second downswing than in the first, because of the rise in productivity. Moreover, since the population has grown between the first and second downswing the number of unemployed would (apart from offsetting changes in labour force membership rates) be greater at the given income during the second downswing, even if no change in productivity had occurred. Thus both factors of growth in the economy, increasing population and increasing productivity, serve to increase, from one downswing to another, the degree of unemployment corresponding to a given level of income. However the degree of unemployment is the principal factor determining the variation of personal saving with income.[68]

The point may be made with the aid of Diagram 3. 7. Let S_1 and S_2 represent the saving-income relations in downswing one and downswing two respectively. Let OY represent the given level of income referred to above. The effect we have described, that is, the reduction in saving corresponding to OY from AY to BY between the two downswings, clearly implies a movement to the right of the saving-income line.

While we have couched the argument for purposes of exposition in terms of a comparison of two downswings, this is merely illustrative. The argument also holds if we compare the level of intended saving corresponding

[68]The reader is referred on this point especially to the paper, cited several times above, by R. C. O. Matthews, "The Saving Function and the Problem of Trend and Cycle", especially pp. 77-82.

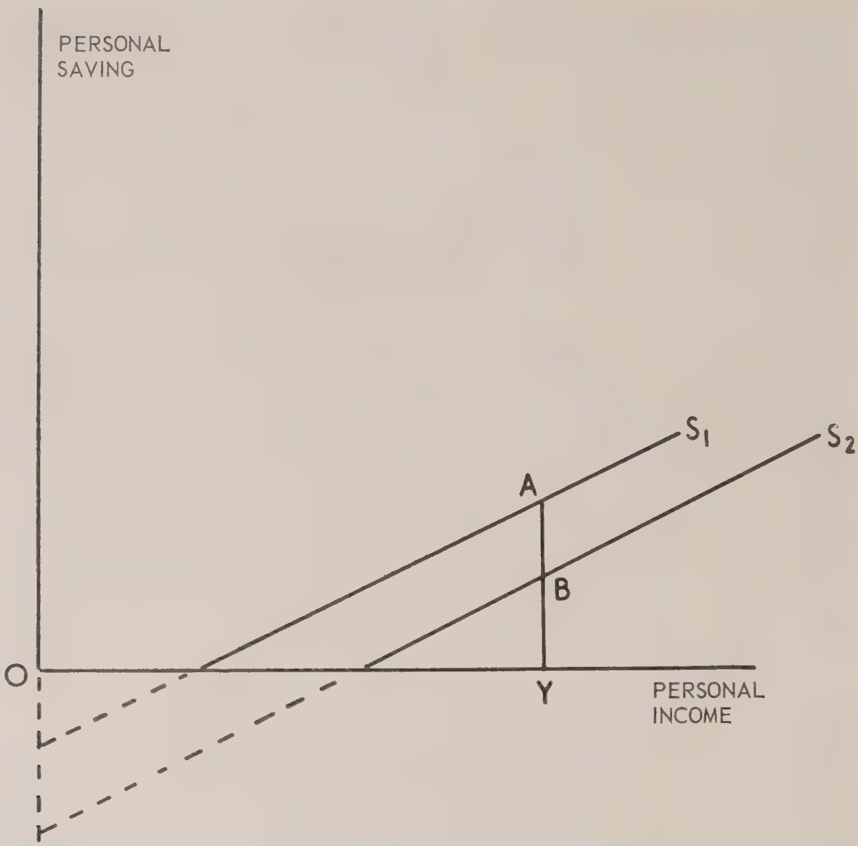


Diagram 3.7

to a given level of income in one upswing with that in the next, or in an upswing with that in the subsequent downswing.

Our revised hypothesis concerning intended personal saving is thus that intended personal saving varies directly with personal income and inversely with population and productivity.

We turn next to gross business saving, made up of depreciation allowances and other retained earnings. The latter, we shall continue to assume, vary directly with business income and inversely with net worth of business or the stock of business real capital. Depreciation allowances on the other hand will vary directly with the stock of capital and in a growing economy will increase progressively from one cycle to the next as the average level

of the stock of capital rises.[69] We shall continue to assume that the effect of changes in the capital stock on depreciation allowances is outweighed by its effect on retained earnings though we are obliged to repeat that the evidence is cloudy on this point.

Combining the hypotheses concerning personal and business saving, and using the simplifications adopted earlier, we now have that intended saving in the economy varies directly with output, inversely with the stock of capital and inversely with population and productivity. Because of the influence of increasing population and productivity the saving-output curves shift to the right across the saving-output graph. However, at times when the stock of capital is decreasing, it may be that the effect of reductions in the stock of capital will outweigh the effects of increases in population and productivity and that the saving-output lines will shift to the left temporarily. This effect may best be discussed as part of the description of the progression of cycles under the assumptions we have adopted, to which we now turn.

We shall describe the progression of cycles in this special model economy that experiences a constantly growing population and a constantly increasing effect of innovations upon productivity with the aid of Diagram 3. 8. This diagram looks hopelessly complicated (and perhaps it is) but essentially what it portrays is a sequence of cyclical movements, each roughly (but only roughly!) similar to that shown earlier in Diagram 3. 6 and already discussed. The family of parallel rising solid lines represents the relation among intended investment, output and capital, and the family of parallel rising dashed lines represents the shifting saving-output relation. The dotted line RR again shows the required replacement expenditures corresponding to each level of output (and hence of the capital stock). We shall refer to the other three dotted lines later. This diagram, too, is somewhat stylistic and schematic as we shall try to indicate as we proceed.

The change in assumption that distinguishes the present model from the earlier static model is the introduction of constantly increasing population and productivity. We have already deduced that one implication of the changes in assumptions which distinguish the present model from the earlier static model is that the saving function will shift to the right as population and productivity increase. But there are further implications of profound significance: in particular that the business cycle is not repetitive, that the levels of output, employment, capital and other indicators, are higher at each successive upper turning point (or lower turning point). The economy

[69]Indeed, in growing economies saving through depreciation allowances may exceed requirements for funds for replacement. The more rapid the secular rise in prices, the more likely it is that the growth of depreciation allowances will be exceeded by the growth of demand for funds for the replacement of capital. The matter is discussed further in Chapter 6 below, and on the whole topic of depreciation allowances and replacement expenditures in a growing economy the reader is referred to Robert Eisner, "Depreciation Allowances, Replacement Requirements and Growth", *American Economic Review*, Vol. XLII, 1952, pp. 820-831; E. D. Domar, "Depreciation Replacement and Growth", *Economic Journal*, Vol. LXIII, 1953, pp. 1-32; Eric Schiff, "A Note on Depreciation Replacement and Growth", *Review of Economics and Statistics*, Vol. XXXVI, 1954, pp. 47-56; and H. D. Huggins, "Some Investment, Depreciation, Savings and Capital Productivity Relationships in Economic Growth", *Social and Economic Studies*, Vol. 4, 1955, pp. 1-31.

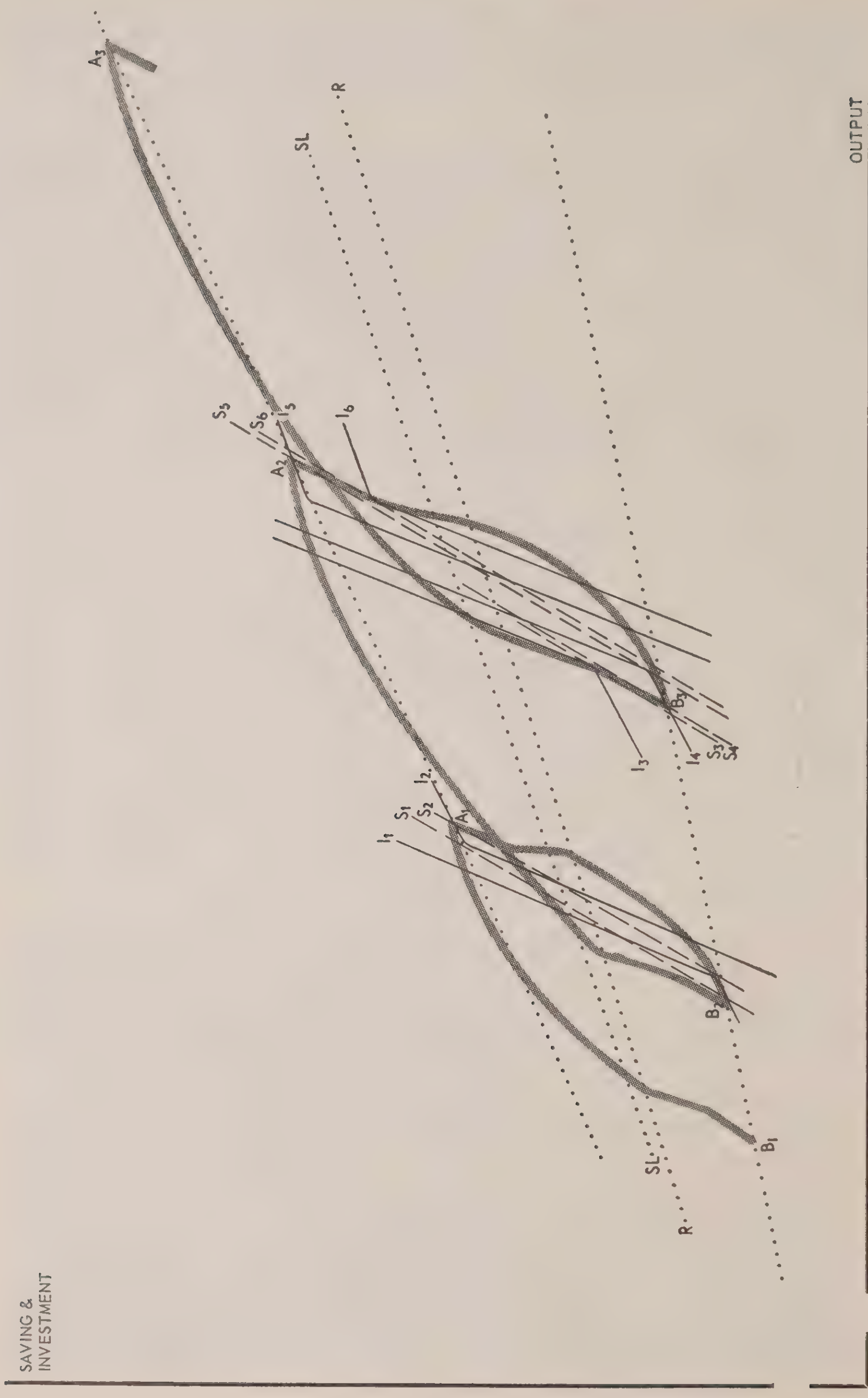

SAVING & INVESTMENT
OUTPUT
A1
A2
A3
B1
B2
B3
SL
R
S1
S2
S3
S4
S5
S6
I1
I2
I3
I4
I5
I6

Diagram 3.8

grows, albeit falteringly. It is this implication especially that we want now to explain.

Intuitively it is plausible that if the population and ability to produce, as measured by productivity, are increasing, the absolute levels of income, employment and capital will rise secularly. Perhaps we can best explain why this is likely to be the case by asking what would be the implications of repeating cycles under the present assumptions. Suppose, for example, that a downswing did not terminate until the level of income returned to the level it had shown at the termination of the previous downswing. Since under the present assumptions the saving-output relations corresponding to any particular level of the stock of capital are shifted to the right by rising population and productivity, the implication is that the stock of capital would be considerably lower at the termination of this downswing than at the termination of the previous downswing. But this would imply that the capital-output ratio was considerably lower also and the profit rate correspondingly higher and the expected profit rate therefore probably also correspondingly higher. Now while it is conceivable that in isolated cases the state of business pessimism may be so intense that a recovery of income and employment will only set in after they have reached levels even below those obtaining in some previous troughs, but at any rate when profit rates have reached a point considerably above those that have induced previous recoveries, it does not seem at all reasonable to expect a progressive, secular rise in the rate of profit at each successive lower turning point. Rather, we should be inclined to suppose that by and large, and with due allowance for the likelihood that in fact each specific cycle will exhibit characteristics peculiar to itself, there would be no secular change in the rate of profit at the successive lower turning points so that as a consequence the capital-output ratio at successive turning points would show about the same value.[70] But if this is the case then the levels of income, capital and employment will all be higher at each successive lower turning point.

Similarly, suppose that an upswing terminates when income merely regains the level it had achieved at the onset of the previous downswing. Again because of the effect of increasing population and productivity in shifting the saving-output line pertaining to each level of the capital stock, we have to infer that the stock of capital would be considerably lower than at the termination of the previous upswing. Further, the capital-output ratio would also be lower, the profit rate higher and likely the expected profit rate higher. But once again, though we may allow for special cases of extreme pessimism, there is surely no case for progressive pessimism in the record of experience of the countries in the backs of our minds as we

[70]It would be necessary to modify this conclusion if there were convincing evidence of a secular shift in the distribution of income as between profits on the one hand and wages, salaries and other forms of income on the other hand. But as we saw in Chapter 2, the evidence does not seem to contradict the hypothesis that secularly in Canada, the United States and the United Kingdom, at any rate, this distribution of income is not changing one way or the other.

consider these matters. In view of the apparent secular constancy of the distribution of income as between profits and other forms of income, we should expect that the rate of profits at which apprehension about the future sufficient to induce a downturn of output and employment would set in would be roughly constant from one peak to the next. But if this is the case the levels of output, employment and capital will all be higher at each successive cyclical peak.[71]

The above analysis explains part of the pattern of growth that we have illustrated in Diagram 3. 8, but other features require detailed comment. We shall not elaborate on the course of events over each cycle; the mechanism of the cycle itself we take to be the same as that described earlier in discussing the case of repeating cycles.[72] We wish to draw attention specifically to the dotted lines, the one through the peaks A_1, A_2 and A_3 of the cycles, the one through the lower turning points B_1, B_2 and B_3 and the one labelled SL. Though it is not shown on the diagram, each of these three lines is drawn to pass through the origin and the following interpretation of the lines is of this fact as well.

The line SL represents the long-run (secular) saving-output or investment-output relation, with the variables interpreted as realized and measured quantities. Consistent with the interpretations of the data given in Chapter 2 we have represented this as a straight line through the origin exhibiting a constant ratio of saving to income or average propensity to save. As mentioned earlier several authors have proposed specific theories to account for this feature of the economic record. Most of them concentrate, however, on personal saving rather than total saving; much speculation on the whole phenomenon appears still to be required.

Several authors have provided *a priori* bases for the hypothesis that each "individual consuming unit" will plan to consume and hence also to save a constant proportion of that part of his income, whatever its level, that he regards as in some sense "permanent" (to borrow the phrase from Professor Friedman).[73] Since expenditure on goods and services is considered to be less readily adjusted to unexpected changes in income than saving, it is also implied in these theories that the larger proportion of an unexpected "recent" change in income, not yet regarded as permanent, will be reflected in changes in the amount saved. The generalization of this hypothesis to all consumer units involves assumptions or further hypotheses concerning changes and offsetting effects of changes in the distributions of consumer units with re-

[71]The proposition is argued too rigidly in the text. In Chapter 2 we reported that we have observed in some mature economies is a capital-output ratio that fluctuates mildly around what is, so far as we can determine, a fairly constant level. Refinement along this line would, however, still support the proposition that with growing population and productivity, the observations of income, capital and employment pertaining to any given stage of successive business cycles will have rising values.

[72]As will be recalled from the analysis of the repeating cycle, the saving and investment lines are considered in pairs in the description of the cycle. We have labelled the lines in Diagram 3. 8 so as to indicate the pairs to be considered together. Thus I_1 and S_1 pertain to the same level of the capital stock and are to be considered together as are I_2 and S_2, I_3 and S_3, etc.

[73]See his *A Theory of the Consumption Function* cited earlier and soon to be published.

spect to such characteristics as family size and composition, age and occupation of head, that determine the saving ratios for consumer units of different kinds. Though it is not essential that we go into the matter here, we wish to point out that a common feature of all analyses of this type is an emphasis on the importance of past incomes and wealth in determining current levels of saving. On the average over the cycles, with secularly rising income, one would expect that the proportion of consumer units having "recently" experienced increases in income that they would hesitate to regard as permanent exceeds somewhat the proportion of consumer units having "recently" experienced decreases in income that they would hesitate to regard as permanent. If past income is, in this way, important in determining current consumer expenditures and if the other features of the hypotheses are accepted, it follows that the secular value of the ratio of personal saving to personal income would be the higher, the higher the average rate of growth of income. Moreover, if we consider personal saving ratios only at the *peaks* of successive cycles, rather than on the average, we would expect the proportion of consumer units enjoying recent increases in income to be larger than in the previous case and hence the consumption-income ratio also to be lower and the saving-income ratio to be higher. Similarly, if we consider personal saving ratios only at the lower turning points of successive cycles, we would expect the proportion of consumer units suffering recent decreases in income to be larger than the average proportion over all cyclical experience and hence the consumption-income ratio to be higher and the saving-income ratio to be lower.

The theory of corporate saving that we have suggested above implies that business saving may also display characteristics similar to those exhibited by personal saving. According to this theory, planned saving would include additions to depreciation reserves and planned retained earnings, the latter being expected profits less the proportion expected to be paid as dividends. An enterprise that adheres to the practice of paying a fixed proportion of its expected profits to shareholders, and that expects depreciation on its real capital assets, as well as its profits, to rise *pari passu* with its net worth, may be said to plan to save a constant proportion of its net income (calculated either before or after deducting depreciation). The actual saving of the enterprise will then be greater or less than planned saving depending upon whether profits exceed or fall short of those expected. If individual enterprises behave in this way, then total business saving could be expected to appear as a fairly constant proportion of total business income over the long run provided that changes in the concept of normal, and the effects of changes in the distributions of enterprises by such salient characteristics as age and class of business, did not dominate the record. Moreover, if the ratio of profits paid as dividends is slow to change, we would expect, as with personal saving, that the ratio of business saving to business income would

be the higher the greater the average rate of growth of income. We would further expect business saving to be a higher proportion of business income when income and saving at cyclical peaks only are considered than when the average levels of income and saving over full cycles are taken into account. Similarly we would expect business saving to be a lower proportion of business income if income and saving are averaged over cyclical troughs than if they are averaged over full cycles.

Even if personal saving and business saving were shown by the long-run records to be constant proportions of personal income and business income respectively it would not follow that total saving would be a constant proportion of total income. But we may remark that together business and personal saving constitute the great bulk of total saving and for the United States at any rate we have the evidence of Goldsmith that "no definite significant long-term trends are visible in the distribution of national saving among the main saving groups during the past half century . . . "[74] In any event, while we feel the theory of the subject still leaves much to be desired, the data we have are convincing on the matter of the long-term constancy of the saving-income ratio in the record, and that is why we have drawn the SL line as straight and through the origin in Diagram 3. 8.

The theory we have been discussing also lends some support, as we indicated, to the view that a saving-income relation through the peaks of the cycles would exhibit a higher ratio of saving to income than that shown by SL and that a saving-income relation through the troughs of the cycles would exhibit a lower ratio of saving to income than that shown by SL. This is the way we have drawn the lines through A_1, A_2 and A_3 and through B_1, B_2 and B_3, though in these cases we have not such clear-cut support from the data in the record as we have for the SL relation. Moreover, we have implied that the ratio of the difference between saving or investment at the peak of the cycle and at the trough of the cycle to the average value of income over the cycle is constant; that is, that the amplitude of the fluctuations in saving relative to income is constant. This, being an implication of the saving-income lines we have drawn through the peaks and troughs, is therefore hard to justify on the basis of the record.

There is another feature of the construction we have given in Diagram 3. 8 that is consistent with the record. Consider for a moment the short-run saving-income relations that would be found from recorded data for each upswing and downswing treated separately. In the diagram they would be shown as the zigzag pattern formed by lines (not necessarily straight) joining B_1 to A_1, A_1 to B_2, B_2 to A_2, A_2 to B_3 and B_3 to A_3.[75]

This picture of cycles in an economy subject to constant rates of increase of the population and of the effect of innovations on productivity,

[74] R. W. Goldsmith, *A Study of Saving in the United States*, Vol. I, p. 131.

[75] See R. C. O. Matthews, "The Saving Function and the Problem of Trend and Cycle", Part II.

reflects the features of secular growth that we examined in Part I of this chapter. The key variables on which we have concentrated our attention do not, it is true, exhibit steady growth. On the contrary, they fluctuate. But when their values at equivalent phases of successive cycles are compared, they are seen to rise at rates which the theory in Part I would lead us to relate directly to the rates at which population and productivity are assumed to increase. We have explicitly incorporated in both analyses the assumption that the secular ratios of saving and investment to income are constant. Utilizing the empirical observation that the proportion of income received as profit is subject to but little variation in the long run we have inferred that the ratio of capital to output at equivalent phases of successive cycles will also show little variation. These features of the model also imply that the average rates of increase (or the rates of increase from peak to peak or from trough to trough) of output, capital, saving and investment will all be equal. To pursue the discussion further in this direction would necessitate retraversing much of the ground covered earlier in this chapter in studying the characteristics of equilibrium among growth rates. Suffice it to point out that the approaches we have taken in the first two parts of this chapter are consistent with each other.

The diagram that we have used to summarize the characteristics of growth via cycles implied by the present model is stylized in some respects that deserve specific comment. In the first place, it should be observed that while we have shown replacement expenditures as a substantial proportion of total investment and as a consequence implied that during each depression there will be some reduction in the stock of capital, a large replacement proportion is not required by the internal logic of the theory. It is quite consistent with the general theoretical framework to suppose that replacement expenditures are a sufficiently small proportion of total peak investment and/or that the rate of increase of population and productivity are sufficiently rapid to permit expected profit rates to recover and end each downswing before the stock of capital is reduced. Of course there is likely to be reduction in the stocks of some kinds of capital, especially inventories, in any downswing.

Secondly, no particular significance should be attached to the precise phase of the upswing at which the previous peak level of income or the previous peak levels of intended saving and investment are reached. As in the case of the repeating cycles, there is no particular significance to the duration of any of the particular phases of the upswing and of the downswing. If we interpret the shaded line as the path of *realized* saving and investment, we see that during the downswing saving and investment first fall rapidly, then more rapidly and then progressively less rapidly with respect to output, while during the upswing they rise first rapidly, then more rapidly and then progressively less rapidly again with respect to output.

The precise duration of each of these phases, and the precise magnitudes of the relative rates of change in each may be varied within the general framework of the theory as specified.

The theory of cycles in an economy with population and the effects of innovations or productivity increasing at constant rates does imply, however, that the increase of output and capital during the upswing will be greater in absolute magnitude than the decrease in these variables during the downswing. Moreover, whatever the precise pattern of the cycle it is in the spirit of the model if not explicitly required by it that the pattern be the same for all cycles. There is a rigidity about the evolution of the economy implied in the theory that is not consonant with the facts as we observe them. But this leads us to our final stage of this excursion into the theory of cycles in a secularly expanding economy in which we examine some, at least, of the features of experience that modify the harsh, rigid outlines of development implied by the theory we have just outlined.

In the model of economic development described above we have taken the rate of growth of population and of the effects of innovations on productivity as given. By so doing we have in fact imposed the trends discussed in Part I of this chapter on the system without offering any fundamental explanation of them. We have it is true, offered rather cautious explanations of the relation of the slope of the long-run saving function to the rates of growth of population and productivity and have argued that given this long-run saving function and certain other structural features of the economy that determine the functional distribution of income, expectations of profit rates and so forth, the rates of growth of income, employment, capital and investment (to mention the chief variables on which we have concentrated), from cycle to cycle, will be determined by the rates of growth of population and productivity. But all this is not sufficient. What gives the economy its fundamental drive? What determines rates of growth of population and productivity? It is at this point that we are driven out to the very frontiers of economics and beyond. It is here that we find our theories are even more tentative and speculative. We are able to state somewhat hesitantly several propositions concerning changes in population and the rate of introduction of innovations and this we shall do in the remaining paragraphs of this essay. But in the end we are carried beyond the more familiar territory of economics into the analysis of what we have called in the beginning of the essay the basic determinants of economic growth. The analysis of the spirit of the people, economic institutions and their evolution, and the knowledge of techniques is the analysis of the very stuff of economic growth; it is the analysis of the sources of the fundamental drive of the economy and the conditions which permit its expression in rising standards of living and economic achievement. Regretfully we must cease our speculations in this essay at precisely the point where, we think, they become most interesting and most fundamental.

The factors affecting the growth of productivity are myriad. Changes in the training and intensity of application of those in the labour force are significant; the shifts in the distribution of output as among industries are important; changes in the ratio of capital to labour, and the rate at which resources are discovered and exploited are important. Especially significant, we believe, are the improvements in capital equipment and methods of organizing economic activity which, earlier, we referred to as innovations. It is by no means likely that these improvements will be introduced at a constant rate. *Ideas* for new improvements may or may not occur at a constant rate—the question is of no concern to us—but the *application* of the new ideas will very likely be related to the cyclical movements of business and indeed contribute much to the very character of the cyclical movements. This was the view that the late J. A. Schumpeter took of innovations, cycles and growth. Innovations will most likely be introduced during the upswing of the cycle when profit rates are high and rising, and much of the cumulative character of the upswing may be explained in terms of the progressive infection of innovating entrepreneurs with confidence and optimism and a sense of opportunity. Always there are some who recognize opportunities first and undertake expansion or the introduction of new methods. But the spirit of optimism thus generated spreads and the adoption of some new methods leads to the adoption of further new methods. This is the cumulative character of the upswing in progressive economies. Some have seen a pattern in the character of the innovations made at successive stages of the cycle and have suggested the hypothesis that typically, though not inevitably, the innovations introduced in the earlier stages of the upswing are predominantly capital-using while the progressive adaptation to these major changes in the capital equipment of industry involves the introduction of ever more capital-saving techniques. There may be dispute as to whether a pattern of this kind can be discerned but there is very little dispute that the introduction of the great innovations that add so considerably to the productivity of labour is concentrated in the upswings of the cycle and is indeed, in the major upswings in our records, at the very heart of the process. While we may disagree with Schumpeter over some of the details of his account, we must concede that in focusing attention on the "bunching" and multiplying of innovations during the upswings he contributed immeasurably to our understanding both of cycles and of growth. This view of the bunched introduction of innovations forces us to recognize that the assumption of a constant rate of growth in the effects of innovations on productivity must be modified.

We also assumed earlier that the rate of growth of population is constant. This assumption, too, requires modification. It is not consistent with the facts in the record and it is not consistent with *a priori* expectation. The size of the population of a country both affects and is affected by economic conditions. This applies both over the cycle and over the longer run. Factors

affecting fertility and mortality rates are numerous and work in complicated ways that are not thoroughly understood. But it appears to be an acceptable hypothesis that if the cyclical swings in economic activity are fairly wide, fertility rates will be affected and the shadows of these effects will be cast forward so as to influence subsequent cyclical behaviour. Moreover, over the longer run there can be no doubt that, in advanced countries at least, fertility rates of most groups in the population will vary directly with the rate of growth of living standards though the shifts of population that accompany economic growth may diminish or even reverse the over-all effect. Relative rates of economic growth in different countries in both the long run (as we have noted) and the short run also affect the flows of migrants though here, too, factors other than economic are operative. The more rapidly a country is growing the more attractive does it appear to be to immigrants and conversely.[76]

A growing population provides an important stimulus to economic activity in the aggregate as we have argued above. But does the increase in population result in a proportionately greater increase in output and hence a rise in output per head? It is true that an acceleration of population growth is often associated with periods of prosperity and indeed may contribute to the spirit of optimism so often essential for the introduction of new techniques and methods. It is also true that increases in population may yield increasing returns by permitting wider division of labour and fuller, more effective utilization of some types of equipment and productive capacity. But, on the other hand, additional population requires additional capital and increased supplies of consumers' goods. It may also yield diminishing returns if some factors of production are forced to work too intensively and if the extra high marginal costs of new capacity that cannot immediately be used to the full have to be incurred. The answer to our question depends upon the weighing of these opposite effects. Thus while it is clear that an increase in the number of people in an economy will result in an increase in the output of the economy it is not at all certain that an increasing population of itself guarantees an increase in incomes per head or in standards of living variously interpreted.

We conclude that the population does not in fact increase at a constant rate and that economic conditions, cyclical and secular, influence the rate of population growth.

But even though innovations are introduced in bursts and population movements reflect economic conditions, the main theme of our argument is not altered. Indeed the "bursting" of innovations is consistent with the view that growth occurs primarily during the upswings of cycles when

[76]There may well be an intimate connection between great waves of migration and fluctuations in types of investment, especially construction (though both waves are of somewhat longer period than that of the business cycle we have been discussing). Brinley Thomas has developed this theme at some length and we regret that we cannot examine it in some detail here. We have mentioned it earlier in Chapter 2. See Brinley Thomas, *Migration and Economic Growth,* Cambridge, England, 1954.

capital accumulation of both new and older forms advances most quickly. It supports the view that the rate of growth of output and output per head will be the more rapid the more inventive and adventuresome are entrepreneurs. The fundamental fact remains that both booms and recessions, the evidences of short-run instability, are terminated and reversed by the stabilizing influences of the persisting long-run structural features of the economy—the concepts of normal proportions and magnitudes in the minds of decision-makers and the mobility of resources in response to changing prospects for gain. The outlines of mature economic development are not as rigid as we have drawn them, the constants of economic life are not constant in the way the force of gravity on the earth is, but the range within which the long-run rates of growth of the key economic variables may vary has been limited, is limited, and may be expected to be limited.

There are some influences on the character of cycles and hence growth that are properly within the economic sphere that we are forced by limitations of time to pass over. Among these are the international interactions of cyclical movements. These are especially important in Canada and we would not wish to argue that the fluctuations in Canadian business and the rate of growth of output, employment and capital in Canada are wholly domestic affairs, though it is more likely that cycles in North America may usefully be so considered. We have argued above that differences in the rates of growth of the United States and Canadian economies will continue to be small. This is not only because of long-run influences of the United States economy on our own but also because the character of growth is influenced by the character of cycles and Canadian economic cycles are not independent of American. As in the case of long-run influences so in the case of shorter run influences, the vehicles for the transmission of economic forces from one country to another include ideas as well as demands for and supplies of goods, services and financial capital. We trade heavily with other countries, especially the United States, importing most of our foreign goods and services from the United States and sending a large proportion of our exports to that market. In addition, from time to time we are heavy borrowers of United States funds. But we also read their business magazines and papers, listen to their radio commentators and visit their executives. Indeed, not a few of our business concerns are controlled in the United States. It would be surprising, therefore, if the attitudes of those in control of Canadian enterprise were not influenced in assessing the economic outlook and initiating business plans by the views in the American business world. One of the studies of this Royal Commission, *Canada-United States Economic Relations,* is, as we noted earlier, devoted in part to a study of Canadian and American business cycles.

Though we have also had to pass over the role of government and government policy in business cycles, we would like briefly to mention two

related aspects of government economic activity in this context. We have emphasized very strongly the role of investment expenditures both in our analysis of cycles and in our earlier analysis of trends. In this part of the essay we have directed attention particularly to that part of investment expenditure (including both that which maintains and expands existing facilities and that which accompanies new innovations) which is made in response to appraisals of the prospects for future profits. But a very substantial proportion of investment expenditure is undertaken by government (of one level or another) and this investment is not usually undertaken in anticipation of profits.[77] Much of it is what is sometimes referred to as social capital and it is undertaken in anticipation of or under the pressure of needs for schools, roads, sewers and the like. The timing of it may be similar to that of private investment or quite different. If the timing is similar, the forces in the private economy making for cycles are thereby augmented, if not they may be offset, and this leads us to our second point. The point is this: To the extent that the government, by appropriate timing of its investment expenditures, adjusting of tax rates, and fiscal and monetary policy generally, can diminish the duration and intensity of cyclical downswings, to that degree it will, other things being the same, increase the rate of growth of output and capital.[78] This seems to follow readily from our analysis without need of elaboration. We are involved in an uncomfortable number of predictions in this book already without attempting more, but we will venture the opinion that if the basic organization of economic activity remains as it is today, while we may expect improvements in the ability of government to offset downswings, we should nevertheless expect fluctuations in activity, of moderate degree at least to remain a feature of our records.[79]

We now come to our final observations. The essence of our view is that economic growth is irregular; it occurs in spurts.We have concentrated our attention on those fluctuations in the record commonly referred to as business cycles, though we would recall that there are apparently longer waves in the historical record that we have not attempted to discuss. We have laid

[77]Many writers on the subject of trends and cycles distinguish "autonomous" and "induced" investment, including in the former category all investment that is not related "directly" to changes in output. Most government investment and some private investment is included in the category "autonomous" investment. Some, notably Professor Hicks (*A Contribution to the Theory of the Trade Cycle*, Oxford, 1950) have introduced a rising trend in autonomous investment as the fundamental factor of growth in the economy. We have not used the term "autonomous" investment partly because it seems too difficult to define clearly, in terms of observable characteristics, but we recognize that not all investment is undertaken in anticipation of profits. We have not followed Professor Hicks because we feel he has too narrowly restricted his model by concentrating on one essentially (but not admittedly) unexplained factor of growth.

[78]A few writers, including Schumpeter, have argued that depressions have some salutary effects on economic efficiency, that incompetent entrepreneurs are forced out of their chosen lines of endeavour, that workers are spurred to greater effort by the threat of unemployment and that without depressions we would not experience the great bursts of economic growth. But these lines of argument are debatable to say the least.

[79]The amplitude of cyclical fluctuations depends in part on the success of government fiscal and monetary stabilization measures, but it also depends on the collective tendency of entrepreneurs successively to overestimate and underestimate their prospects for profit. Thus whether cycles may diminish in amplitude depends in part also on whether entrepreneurs learn from experience. But the particular entrepreneurs who lead in organizing economic activity change from generation to generation and the period of one cycle may be as much as ten years or nearly half of the period of a generation. One sometimes suspects that the old cannot teach the young much and that many of the "drivers" among entrepreneurs are apt to be young. On the other hand the supply and analysis of economic data available to entrepreneurs generally is undoubtedly increasing and improving.

great stress on the role of changing profit expectations in explaining the cyclical movements of economic activity. Expectations are essentially psychological phenomena and their formation is subject to the influences of the crowd as well as the record. This being the case, it is no surprise that cycles, though displaying some uniformity of pattern, also show considerable diversity. We have contended that the forward thrusts are achieved in the boom phases of the cycle when the great innovations are introduced and new additions to capital planned. Thus, if entrepreneurs have a bias toward optimism the rate of economic growth will be higher. As one writer has recently expressed it,

> ". . . both the trade cycle and economic growth are the resultant of particular attitudes of enterpreneurs—more precisely, of the volatility of entrepreneurial expectations . . . If expectations are responsive but sluggish, we might get a moderate cycle, with weak booms and weak slumps and an equally weak trend. It is when expectations are highly volatile that the expansionary phase of the cycle is likely to be vigorous and sustained . . . the subsequent slump, though severe, will not mean a return to the previous depression level . . . The same forces which produce violent booms and slumps will also tend to produce a higher trend-rate of progress."[80]

But we have also contended that the mainsprings of growth lie deep in the social structure. Their analysis and explanation will continue to be the subject of the speculations of philosophers, historians and social scientists of the coming generations. We close with the conjecture that the rate of economic growth will be higher in an economy with a reliable government and a high degree of social mobility where a talented, thrifty, hard-working population shares a materialist philosophy. People must want goods, know how to produce them and be willing to work and save for them if they are to have them in increasing abundance.

IV. *From Theory to Forecast*

In this chapter we have examined the conditions of equilibrium among the levels and rates of growth of selected key economic variables. We have also examined the theory of business cycles and the relation between the character of cycles and rates of secular growth. Our synoptic view of growth in Chapter 2 led us to focus attention on certain key relationships whose long-run stability, though by no means absolute, was nevertheless remarkable. Our theoretical speculations in this chapter incline us to formulate our conjectures concerning the future growth of output, employment and capital with the aid of these relationships, though not, we hope, blindly and without qualification or modesty.

[80]N. Kaldor, "The Relation of Economic Growth and Cyclical Fluctuations", p. 71.

We have remarked that when one observes the record of economic activity standing, as it were, well back from one's charts, the general impression is of smooth lines, for the most part either level or rising, but that when one examines the charts more closely a great variety of movements, some quite irregular and some with more pattern, may be discerned. In forecasting the levels and rates of growth of economic activity in Canada, we shall again take up our position well back from the charts, in that we shall not attempt to forecast the irregular or the more patterned cyclical movements in economic activity. Mindful of the theoretical argument of Part III of this chapter, however, we recognize that rates of growth depend intimately upon the character of business cycles.

Let us explain rather more precisely what we shall try to forecast. Several alternatives are open to us. We might attempt to forecast what levels of output, employment and capital will actually be realized in each year or in selected years over the period of forecast. We might try to forecast the values of output, employment and capital in selected years on the assumption that on those dates the economy will be neither at the peak of an upswing or the bottom of a downswing but rather at an intermediate position. We might try to forecast what the values of these variables would be in selected years if the economy were at the peak of an upswing or at the bottom of a downswing. Or finally, we might try to include both of these latter extremes in our forecasts for a particular year. We have, in fact, tried to forecast the potential levels of output, employment, capital and so forth in a fully employed economy.[81] Perhaps our objective can best be described as follows. Picture the graph of Canadian real output, for example, over the next 25 years. This graph of levels of output that are assumed to be actually realized will be generally rising, but it will also show moderate upswings and downswings in economic activity. We assume that it will not show major downswings, such as that following 1929, or wars of the scale of World War II. Picture further, now, a line on this chart through the levels of yearly output produced when the annual average percentage of the labour force employed is 97%. Our forecast of real output is to be interpreted as a forecast of the value of output for the years 1965, 1970, 1975 and 1980 as measured along this line through the peaks. Our forecasts of the employed labour force, the stock of capital, Gross National Expenditure and its components are all to be given a similar interpretation.

The slope of this line of potential output reflects our views as to the character of cycles to be experienced in North America (in particular) and the likely effectiveness of governmental measures on this continent to cope with the excesses both of recession and inflation. We have argued that in the present organization of North American economies, rapid growth is likely

[81]By a "fully employed economy" we mean for Canada one in which at least 97% of the labour force is employed on the average in a year.

to have to be bought at the price of a tendency to short-run instability, but that the more effective are government measures in curbing inflation and recession, the more rapid will be the rate of growth. We do not attempt, however, to forecast whether the year 1965, for example, will be a year of boom or downswing. We only attempt to forecast what might be the level of output in that year if we succeed in employing the labour force fully.

We shall, indeed, present our forecasts as ranges of alternatives. But each alternative pertains to a fully employed economy. The range reflects our uncertainty as to what the capacity of the fully employed economy will be. This uncertainty derives from many sources. We are uncertain what birth rates and immigration will be, what the proportion in the labour force of some groups of the population will be, what the average weekly hours of work per person will be, what the distribution of the labour force as between industries will be, what the value of output per man-hour will be, what the character of our business cycles and effectiveness of remedial government measures will be. All of these uncertainties and others are reflected in the range of our forecasts.

In Chapter 2 we noted, in particular, the persistent secular rise in output per head and output per man-hour, the absence of any pronounced long-term movement in the capital-output ratio, the comparative constancy of the ratio of saving to income over the long run, and the rising trend of the ratio of capital to labour. The theoretical analysis of Part II of this chapter has fortified us in our intention to recognize these and other features of the record in our projections of the future. But it has also warned us against uncritical projection of the past into the future. In Part II, for example, we worked under the assumptions that innovations were introduced at a constant rate and that population increased at a constant rate. All the theorems that we derived in Part II concerning rates of growth and ratios of other variables were based on these assumptions. But we recognized in Part III that these assumptions are restrictive (though they may be less so for secular analysis than cyclical). The models that we studied in this chapter were all greatly simplified and could not reflect the full diversity of economic life, though we feel they reflect some essentials of it.

In our forecasting, while we relied on the use of ratios such as output per man-hour, capital to output, saving to income and others, we did not uncritically apply to the future the values for these ratios or the rates of change in their values that we observed for the past. In significant instances we have allowed more rapid or less rapid change in the values of the ratios than the full sweep of our record indicated. We did not forecast that the population would increase at a constant rate. While we felt obliged to assume that the annual net intake of immigrants would be constant, the natural increase of the population, immigrant and native born, was worked out from

the detail of the age-sex structure with the aid of assumptions concerning fertility and mortality rates.

We shall explain the details of our methods and assumptions in the subsequent chapters. Here it may be remarked that the forecasts depend on an examination of the record on relationships that appear to be among the most stable in the record and theoretical analysis (formal and informal) of these relationships. While we do not believe that the Canadian economy will operate at full potential at all times, we do believe that full potential is greater in an economy with dynamic entrepreneurs and successful stabilization measures. Our forecasts are an attempt to indicate the range within which the potential of the Canadian economy may lie over the next 25 years.

4

THE POPULATION AND THE LABOUR FORCE

I. *The Population*

1. *Canada's Population History—A Synopsis*

Among the developed nations of the Western world, Canada ranks very high in terms of the rate of increase of her population. For example, between 1926 and 1955 the population of Canada increased at the rate of 1¾% p.a.p.a. (or 1 2/3% if Newfoundland is excluded), while the corresponding figures for the United Kingdom and the United States for this period were 5/12% and 1.2% respectively. The populations of Australia and of New Zealand[1] increased by 1.45% and 1.35% p.a.p.a. respectively between 1925 and 1954. The population of Canada, which in 1920 was 1/12 that of the United States, is now greater than 1/11 and seems destined to be of the order of 1/10 very shortly.

A record of Canada's population growth since 1851 is presented in Table 4. 1 entitled *A Population Balance Sheet for Canada, 1851-1955.* From this record it may be seen that in the century ended 1951, our population increased at an average annual compound rate of just over 1 2/3% (1.68%). It will also be noted that the rate of natural increase (per thousand) has always been substantially in excess of the rate of increase attributable to the exchange of persons across our borders. Let us comment briefly on the contribution of immigration and emigration to the change in population.

Table 4. 2 shows first of all that, in the century following 1851, if the children of immigrants are counted as part of the natural increase of the population, the natural increase accounted for 93.5% of the total increase in that period. In 1951 to 1955 natural increase (thus defined) accounted for 73.5% of the total increase. This is perhaps an exaggerated way of expressing the importance of natural increase in the growth of the population. Yet another way of putting the matter, for the 1851-1951 period, is to remark

[1]European population only.

Table 4. 1

A POPULATION BALANCE SHEET FOR CANADA[a] 1851-1955

(thousands)

	Population at beginning of period, June 1	Births[b]	Deaths[b]	Natural increase	Immigration[c]	Emigration	Net immigration	Population at end of period, June 1
1851 — 1861	2,436	1,281	611	670	209	85	124	3,230
1861 — 1871	3,230	1,369	718	651	187	379	−192	3,689
1871 — 1881	3,689	1,477	754	723	353	440	− 87	4,325
1881 — 1891	4,325	1,538	824	714	903	1,109	−206	4,833
1891 — 1901	4,833	1,546	828	718	326	506	−180	5,371
1901 — 1911	5,371	1,931	811	1,120	1,759	1,043	716	7,207
1911 — 1921	7,207	2,338	988[d]	1,350	1,612	1,381	231	8,788
1921 — 1931	8,788	2,415	1,055	1,360	1,203	974	229	10,377
1931 — 1941	10,377	2,294	1,072	1,222	150	242	− 92	11,507
1941 — 1951[f]	11,507	3,186	1,214[e]	1,972	548	379	169	13,648
1951[g] — 1952	14,009	389	123	266	216	61	155	14,430
1952 — 1953	14,430	408	128	280	143	72	71	14,781
1953 — 1954	14,781	427	125	302	176	64	112	15,191
1954 — 1955	15,191	436	127	309	132	35	97	15,601

a Information in this table is taken from N. Keyfitz, "The Growth of Canadian Population", *Population Studies*, Vol. IV, No. 1, June, 1950, especially Table II "A Reconstruction of Canada's Population Record 1851-1950", as revised and brought up to date in *Canadian Vital Statistics Trends, 1921-1954*, Reference Paper No. 70, D.B.S., 1956.

b Births and deaths for periods from 1851 to 1921 inferred by applying mortality rates to decennial censuses.

c Immigration during census years divided into January-May, June-December in proportion of 5/12 and 7/12, until after 1951, when monthly immigration returns used

d Allows for 120,000 deaths due to World War I and the influenza epidemic.

e Allows for 36,000 deaths due to World War II.

f Not including Newfoundland.

g Including Newfoundland.

that in exactly half of the decades of that century we had net losses in the exchange of persons with other countries. Or again, since 1951 our net immigration has been over 60% of our net immigration in the entire preceding century and still can account for only one-quarter of the total increase since 1951.

Table 4. 2

BALANCE SHEETS OF THE CANADIAN POPULATION

1851-1951

Beginning population	2,436
Births	19,375
Deaths	8,875
Natural increase	10,500
Immigration	7,250
Emigration	6,538
Net immigration	712
Closing population (excluding Newfoundland)	13,648

1951-1955
(including Newfoundland)

Beginning population	14,009
Births	1,660
Deaths	503
Natural Increase	1,157
Immigration	667
Emigration	232
Net immigration	435
Closing population (including Newfoundland)	15,601

One should not minimize the importance of net immigration however. We do of course find, looking back over our history since the days of Champlain, that our entire population growth can be considered to have been comprised of immigrants and their descendants. But perhaps this observation is not particularly instructive. What is not so obvious is the fact that since there is no close connection, historically, in the timing of immigrant arrivals and emigrant departures, the Canadian population is larger than it would have been had the inflows and outflows matched each other regularly in each year. This is true even though over longer intervals the inflow and outflow may approximately balance. One authority on the Canadian population expresses this matter as follows:

> "If 100 thousand migrants arrive at the beginning of a decade and depart at the rate of 10 thousand a year, then net migration at the end of the ten years is zero, but the population has meanwhile received a contribution of half a million person-years of life. A pattern roughly similar to this model is observable in Canadian history. Short periods of heavy net immigration have been followed by longer periods of gradual dissipation of the gains. It is estimated that throughout the period 1851-1951 the population has been, on the average, about ten percent larger as a consequence of net migration considered in these terms."[2]

It has been held by some that the Canadian economy behaves rather like a full bathtub in that an influx of immigrants automatically leads to the

[2]N. B. Ryder, "Components of Canadian Population Growth", *Population Index*, Vol. 20, No. 2, 1954, pp. 71-80.

draining off of an equivalent number of emigrants. This Displacement Theory[3] underestimates the importance of immigration. While the figures on emigration are exceedingly scanty and notional, and while it is therefore difficult to check hypotheses in detail, there is much evidence to support the view that the specific factors governing the movement of immigrants into Canada are different from those governing the movement of emigrants from Canada to other countries. If, in the past, there have been strong and independent reasons leading to the loss of persons to the United States, then the importance of immigration in making good that loss, indeed more than making it good, has been very great indeed. If the loss of six and a half million persons, principally to the United States, in the century following 1851 had not been offset by seven and a quarter million immigrants we should have had a very small population in Canada indeed. Conversely, to emphasize the effect of emigration on growth, if the gain of seven and a quarter million immigrants had not been offset by the loss of six and a half million emigrants we should have had a very much larger population.

All of this discussion is at the level of simple arithmetic—we shall not attempt here to evaluate the specific effects on fertility and mortality rates of the international exchange of persons. Information of the requisite detail is lacking for this purpose, but there is some support for the view that if it were available it might suggest further cause for caution in minimizing the importance of immigration and emigration in the growth of the Canadian population.

The rate of natural increase of the Canadian population has not only exceeded the rate of increase attributable to migration, it has for many years exceeded the rate of natural increase in the other countries of the world usually considered to be at least as well developed. As may be seen in Table 4. 3, the crude birth rate (live births per year per thousand of the population) in Canada was, in 1954, at 28.7, higher than in any other of the so-called developed countries listed. Moreover, while the birth rate in Canada has exhibited, in a broad way, the general pattern of crude birth rate movements throughout Europe and North America, the Canadian rate has been relatively high among countries of the Western world, for many decades. On the other hand, the crude death rate (deaths per year per thousand of the population) is and has been among the lowest in the same group of countries. In 1954, at 8.2, it was lower than that of any other country in the group except the Netherlands, where the death rate was reported at 7.5. As may be seen from the table, this favourable experience in terms of the crude death rate is not matched by our experience in infant mortality rates (number of

[3]See for example: W. Burton Hurd, "Some Implications of Prospective Population Trends", *Canadian Journal of Economics and Political Science*, Vol. V, 1939, pp. 492-503; W. Burton Hurd, "Demographic Trends in Canada", *Annals of the American Academy of Political and Social Science*, Vol. 253, 1947, pp. 10-15; M. C. MacLean, "Analysis of the Stages in the Growth of Population in Canada", Ottawa, D.B.S., 1935. For critical discussion, see Mabel F. Timlen, *Does Canada Need More People*, Toronto, 1951, especially Chapters II and VI.

Table 4. 3

GEOGRAPHICAL COMPARISONS
CRUDE BIRTH, DEATH AND INFANT MORTALITY RATES

(from Tables 19, 25 and 28 of the Demographic Year Book, 1955, United Nations)

Births

	1920–24	1925–29	1930–34	1946	1950	1954
Canada [a]	28.1	24.5	22.2	27.2	27.1	28.7
United States [b]	22.8	20.1	17.6	23.3	23.5	24.9
Japan	35.0	34.0	31.8	25.3	28.2	20.1
Austria	23.6	18.4	15.1	15.9	15.6	14.9
Belgium	21.1	18.9	17.6	18.3	16.9	16.7
Bulgaria	39.6[c]	34.2[c]	30.3[c]	25.6	—	—
Czechoslovakia	26.7	22.9	19.7	22.7	23.3	20.5
Denmark	22.6[g]	19.8	17.9	23.4	18.6	17.3
Finland	25.4	22.8	20.0	27.9	24.5	21.3
France	19.9	18.5	17.3	20.9	20.6	18.8
Germany	23.1	19.7	16.3	10.7[d]	16.9[d]	16.6[d]
Greece	—	29.7[e]	30.0	—	20.0	19.2
Hungary	30.2	26.6	23.2	18.7	21.0	21.6
Ireland (Republic) [f]	20.5	20.3	19.5	23.0	21.3	21.1
Italy	30.1[g]	27.2	24.5	23.0	19.6	17.9
Netherlands	26.7	23.4	21.7	30.2	22.7	21.6
Norway	23.5	18.5	15.7	22.6	19.1	18.6
Portugal	33.0	31.7	29.3	25.4	24.4	22.7
Spain	30.0[j]	28.7[j]	27.5[hj]	21.6	20.2	20.0
Sweden	20.3	16.3	14.4	19.7	16.4	14.6
Switzerland	20.0	17.8	16.7	20.0	18.1	17.0
United Kingdom	21.7	17.6	15.8	19.4	16.3	15.6
Yugoslavia	35.3[g]	33.9	33.0	—	30.3	28.4
Australia	24.4	21.6	17.6	23.6	23.3	22.5
New Zealand [i]	23.0	20.2	17.5	25.3	24.7	24.7

Deaths

	1920–24	1925–29	1930–34	1946	1950	1954
Canada [a]	11.9	11.2	10.0	9.4	9.0	8.2
United States [b]	12.0	11.8	11.0	10.0	9.6	9.2
Japan	23.0	19.8	18.1	17.6	10.9	8.2
Austria	16.7	14.7	13.5	13.4	12.4	12.1
Belgium	13.7	13.8	13.2	13.6	12.5	11.9
Bulgaria	21.3[c]	18.5[c]	15.8[c]	13.7	—	
Czechoslovakia	16.5	15.2	13.7	14.1	11.5	10.4
Denmark	11.4[g]	11.1	10.8	10.2	9.2	9.1
Finland	15.6	14.9	13.6	11.8	10.1	9.1
France	17.3	17.3	16.0	13.5	12.7	12.0
Germany	13.9	11.9	11.0	12.3[d]	10.3[d]	10.4[d]
Greece	-	17.7[e]	16.7	-	—	
Hungary	20.9	17.3	15.8	15.0	11.5	11.0
Ireland (Republic) [f]	14.6	14.5	14.1	14.0	12.7	12.1
Italy	17.5[g]	16.6	14.1	12.1	9.8	9.2
Netherlands	11.0	10.0	9.0	8.5	7.5	7.5
Norway	11.8	11.1	10.4	9.4	9.1	8.4
Portugal	21.5	18.7	16.9	14.9	12.2	10.9
Spain	21.0[j]	18.4[j]	16.5[j]	13.0	10.9	9.1
Sweden	12.4	12.1	11.7	10.5	10.0	9.6
Switzerland	12.9	12.2	11.7	11.3	10.1	10.0
United Kingdom	12.5	12.5	12.2	12.1	11.7	11.4
Yugoslavia	17.1	20.0	18.4		13.0	10.8
Australia	9.8	9.4	8.8	10.1	9.6	9.1
New Zealand [i]	9.0	8.6	8.3	9.7	9.3	9.0

Table 4. 3 (Concluded)

GEOGRAPHICAL COMPARISONS
CRUDE BIRTH, DEATH AND INFANT MORTALITY RATES

(from Tables 19, 25 and 28 of the Demographic Year Book, 1955, United Nations)

	Infant mortality					
	1920–24	1925–29	1930–34	1946	1950	1954
Canada [a]	104.7	94.3	79.8	47.6	41.3	31.8
United States [b]	76.7	69.0	60.4	33.8	29.2	26.6
Japan	164.7	140.8	124.2	—	60.1	48.9[k]
Austria	141.6[l]	120.0	100.2	81.4	66.1	48.3
Belgium	108.2	101.3	91.6	74.8	53.4	49.1
Bulgaria	156.8[gc]	149.8[c]	144.1[c]	125.1	—	—
Czechoslovakia	160.0	145.8	128.5	108.8	77.6	37.0
Denmark	82.4[g]	82.2	73.1	45.8	30.7	26.9
Finland	97.9	89.8	73.9	56.2	43.5	30.7
France	97.1	91.4	80.1	71.9	52.0	—
Germany	127.2[g]	98.1	77.8	90.2[d]	55.5[d]	42.8[d]
Greece	84.8[g]	94.2	118.9	—	—	—
Hungary	192.2	175.1	156.7	116.5	85.7	60.7
Ireland (Republic) [f]	71.5	70.3	67.5	64.6	45.3	37.9
Italy	128.8[l]	122.2	105.6	86.7	63.8	52.8
Netherlands	74.4	57.9	46.7	38.7	25.2	21.1
Norway	53.3	50.4	45.2	34.6	28.2	22.0[k]
Portugal	152.8	142.2	144.7	119.4	94.1	85.5
Spain	148.2[j]	127.8[j]	118.0[h]	92.4	69.8	54.2
Sweden	61.4	57.7	51.9	26.5	21.0	18.5
Switzerland	70.3	55.5	49.0	39.2	31.2	27.2
United Kingdom	79.2	73.3	65.5	42.7	31.4	26.3
Yugoslavia	—	149.3	154.9	—	118.6	101.8
Australia	61.0	53.2	42.9	29.0	24.5	22.5
New Zealand [i]	44.9	37.8	32.4	26.1	22.7	20.0

a Excluding Yukon and Northwest Territories.
b Until 1934 data are for birth and death registration states only. By 1932 these states included 95% of total population.
c Excludes data for Southern Dobruja.
d West Germany only.
e For 1928-29.
f Data are births registered within one year of occurrence.
g For 1921-24.
h For 1932-34.
i European population.
j Data exclude deaths of infants dying within 24 hours of birth.
k 1953.
l For 1922-24.

deaths of infants under one year of age per thousand live births). Though, as in most countries, our infant mortality rate has dropped astonishingly in recent decades, it is now and has for many years been above the rates for the United States, Finland, Netherlands, Norway, Sweden, Denmark, Switzerland, the United Kingdom, Australia and New Zealand.

2. *The Present Structure of the Population*

The present population does not show a perfectly regular and symmetrical age-sex structure; the proportion of persons of successively higher ages does not always fall smoothly; the number of males is not equal to the

number of females. Populations never exhibit such features exactly. In Table 4. 4, the age breakdown of the population at each census since 1921 and as estimated at June 1, 1955, is shown for four broad categories.

Table 4. 4

AGE DISTRIBUTION OF THE POPULATION OF CANADA

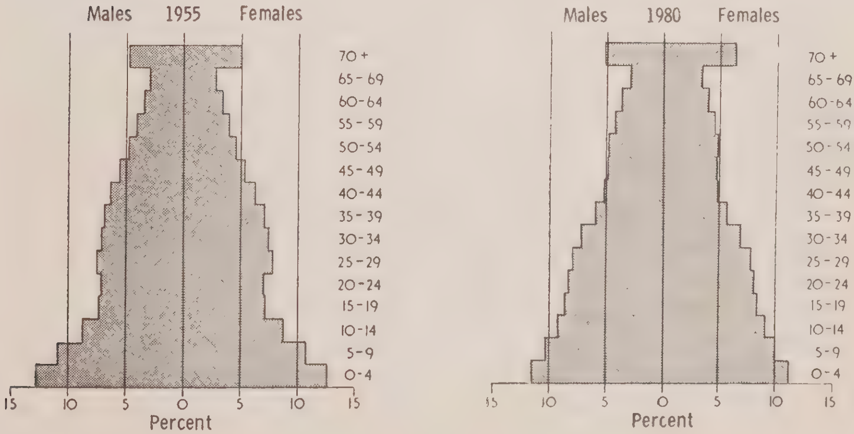
(percentage)

Age	1921	1931	1941	1951	1955
0-14	34.4	31.6	27.8	30.3	32.2
15-44	45.8	46.1	46.9	44.2	42.6
45-64	15.0	16.7	18.6	17.7	17.4
65 and over	4.8	5.6	6.7	7.8	7.8

It will be noted that the proportion of persons aged 65 and over is now substantially higher than 30 years ago. The effect of the movements of the birth rate through depression, war and postwar periods can be seen in the ratios for the 0-14 group. The population pyramid shown in Chart 4. 1 (below) exhibits the age-sex structure of the population as of June 1, 1955. Two important characteristics may be emphasized. A most notable feature is the indentation in the pyramid in the ages 15-25. The comparative shortage of persons in these age brackets, resulting in part at least from the effect of the depression on fertility, will be important in the next quarter century in terms of its effects on the future birth rate and on the size of the Canadian labour force.

Chart 4.1

PERCENTAGE DISTRIBUTION OF THE POPULATION BY FIVE-YEAR AGE GROUP AND SEX
CANADA 1955—80



The number of men in the population has exceeded the number of women at every census since 1901, though the excess of men is now smaller than at any time in the present century, so far as is known. The excess of men is not found at all age levels. Most of the excess is found in the ages 0-24; the rest of it is found in the ages 40-74. In the other age groups there is a small surplus of women. These differences are shown in Table 4. 5.

Table 4. 5

POPULATION OF CANADA: SEX DIFFERENTIALS BY AGE, JUNE 1, 1955

Ages	Men	Women	Men minus Women	
0-24	3,694.2	3,555.0	139.2	
25-39	1,696.7	1,722.7		—26.0
40-74	2,301.1	2,205.3	95.8	
75 and over	191.3	206.7		—15.4
	7,883.3	7,689.7	235.0	—41.4
			—41.4	
			193.6	

3. *Forecasting the Population of Canada: Methods, Underlying Data and Assumptions*

(i) *Methods*

The procedure used in obtaining the population forecasts presented below involved, first, the projection of the natural increase of the present population, and then, separately, the estimation of the net flow of immigrants and their natural increase. Both forecasts were made by five-year intervals. The result of adding them together, by age-sex classes, is an age-sex distribution of the population of Canada, apart from the Yukon and the Northwest Territories, as at June 1 in 1960, 1965, 1970, 1975, 1980.

Deaths: Mortality rates (number of deaths per year occurring among a thousand individuals) pertaining to individuals of a given age and sex were forecast for future quinquennia and used to calculate the effect of deaths in reducing the population. While, as we shall see, mortality rates have been assumed to decline over the forecast period, they have been taken to be constant within each quinquennium. To calculate deaths in each of the five-year classes, 5-9, 10-14, . . ., 85-89, 90+, the following procedure was used for males and females separately. The number of persons (expressed in thousands) in a given age class was multiplied by the fifth power of one minus the estimated mortality rate for persons in that age class to yield the survivors of those persons in the next highest age bracket five years later. For the age class 0-4, a more detailed procedure was used. The number of persons of each sex aged 0, 1, 2, 3, and 4 was determined, and the number of survivors of each group after the lapse of five years was calculated by using death rates specific to each group and each year, to yield the total number of survivors in the 5-9 class five years hence.

Births: Fertility rates (number of live births per thousand women) pertaining to women of given age were forecast for future quinquennia and used to calculate natural additions to the population. Fertility rates, like mortality rates, were assumed to be constant within each quinquennium (though not from one quinquennium to another). In each year of a given quinquennium, the number of live births was taken to be the sum of the products of the number of women (expressed in thousands) in each fertile age group at the beginning of that quinquennium and the estimated fertility rate pertaining to that age group. The number of children aged 0-4 surviving at the end of a quinquennium was calculated by reckoning separately the survivors of each annual crop of babies at the end of the period.

Annual net inflow of immigrants was assumed to be constant over the period of the forecast. Three alternative assumptions were made. The procedure used to calculate the addition to population by age and sex of a constant flow of immigrants over the five quinquennia was as follows: a standard age-sex distribution of immigrants was assumed (for details see below). The vital history over the remainder of the forecast period of the net flow of immigrants added in each quinquennium was considered separately, births and deaths being calculated with birth rates and death rates specific to each age and sex. The total contribution to the population from immigration (including *its* natural increase) by age and sex at each forecast date was obtained by adding the results in these vital histories of each batch of immigrants.[1]

(ii) *Underlying data and assumptions*

Mortality data and assumptions: In Table 4. 6, the history of mortality rates by sex and by age is exhibited along with the forecast of rates for the coming five quinquennia. Certain features of the record stand out—in the first place, mortality rates for women, except in the very highest age groups and, in the first part of the period, in the childbearing ages, are consistently lower than for men; secondly, mortality rates have shown a pronounced tendency to decline, with the rate of decline being higher for lower ages; thirdly, it will be noted that, especially since the depression, mortality rates in most age groups of each sex have shown a tolerably constant relative rate of decline. The actual procedure followed in forecasting the mortality rates was to plot them on semi-logarithmic paper (on which a straight line shows a constant rate of change) to fit free-handedly a straight line giving particular weight to the post-depression data and to project these lines through the forecast period. The forecasts of the mortality rates were read from these projections. The result is perhaps a fairly optimistic view of mortality, but it has the merit of simplicity in addition to that of plausibility.

[1]It perhaps should be remarked that this procedure does *not* depend on an assumption that immigrant women marry only immigrant men or vice versa.

Table 4. 6

MORTALITY RATES

	1926		1927		1928		1929		1930		1931	
	M	F	M	F	M	F	M	F	M	F	M	F
0 ...	113.0	90.0	105.0	84.0	100.0	80.0	103.0	82.0	100.0	81.0	96.0	76.0
5–9 ...	2.5	2.1	2.7	2.4	2.6	2.3	2.7	2.5	2.6	2.0	2.2	1.7
10–14...	2.1	1.8	2.2	2.0	2.1	1.9	2.0	1.9	1.7	1.6	1.5	1.5
15–19...	2.9	2.9	1.8	3.0	3.0	2.7	3.1	2.8	2.8	2.8	2.5	2.2
20–24...	3.5	4.0	3.6	4.0	3.7	4.0	3.7	4.0	3.7	3.6	3.2	3.2
25–29...	3.5	4.1	3.9	4.1	3.9	4.2	3.9	4.3	3.7	4.1	3.4	3.8
30–34...	3.7	4.6	3.8	4.3	3.9	4.6	3.9	4.6	3.7	4.1	3.5	4.2
35–39...	4.8	5.6	4.6	5.4	4.8	5.4	4.8	5.4	4.6	4.9	4.2	4.8
40–44...	5.9	6.1	5.6	5.8	6.1	6.1	6.1	6.2	5.8	6.0	5.4	5.0
45–49...	7.4	7.5	7.4	7.3	8.0	7.4	8.1	7.3	7.7	7.1	7.2	6.6
50–54...	10.1	9.5	10.3	9.3	10.7	9.8	11.2	9.8	10.8	9.3	10.7	9.0
55–59...	15.7	13.5	16.2	13.3	16.5	14.2	15.9	13.8	15.7	13.7	15.4	13.4
60–64...	23.7	21.0	23.6	20.6	24.7	21.2	24.7	21.8	23.2	20.1	22.9	20.7
65–69...	38.1	35.0	37.6	33.3	39.7	33.0	40.4	35.1	37.4	32.8	35.2	30.3
70–74...	62.6	54.0	59.0	49.3	60.6	54.3	60.0	55.5	58.0	50.7	55.0	49.1
75–79...	101.6	92.8	94.8	85.7	101.4	88.8	97.8	91.2	93.2	82.6	87.4	82.9
80–84...	152.5	144.5	137.7	133.1	147.4	143.3	153.4	143.2	141.3	132.8	134.1	127.1
85–89 / 90+ ..	252.6	274.3	246.2	252.8	259.3	267.3	268.6	256.0	242.0	233.5	228.1	212.6

	1932		1933		1934		1935		1936		1937	
	M	F	M	F	M	F	M	F	M	F	M	F
0 ...	83.0	66.0	83.0	65.0	81.0	64.0	81.0	63.0	75.0	60.0	86.0	68.0
5–9 ...	1.9	1.5	1.6	1.3	1.7	1.3	1.8	1.5	1.9	1.7	2.2	1.8
10–14...	1.5	1.4	1.3	1.2	1.4	1.1	1.5	1.3	1.4	1.2	1.5	1.3
15–19...	2.3	2.1	2.2	1.9	1.8	1.9	2.1	1.8	2.1	1.9	2.1	1.9
20–24...	3.0	3.0	2.8	2.8	2.4	2.7	2.5	2.7	2.6	2.8	2.7	2.7
25–29...	3.1	3.6	2.8	3.4	2.8	3.1	2.9	3.3	2.9	3.1	2.8	3.1
30–34...	3.4	4.0	3.1	3.9	3.3	3.7	3.3	3.6	3.2	3.8	3.4	3.7
35–39...	4.4	4.7	3.8	4.4	3.8	4.2	4.0	4.5	4.0	4.5	4.2	4.3
40–44...	5.2	5.4	5.0	5.1	4.8	4.7	5.1	4.9	5.0	4.9	5.2	5.1
45–49...	6.8	6.8	7.0	6.8	7.0	6.5	7.0	6.5	7.1	6.3	7.5	6.5
50–54...	10.3	9.3	10.1	9.2	10.1	8.8	10.2	8.7	10.2	9.2	10.5	9.2
55–59...	15.4	13.6	14.6	13.3	15.2	12.9	15.0	12.9	15.4	12.9	15.8	12.7
60–64...	23.2	20.2	23.3	20.5	24.5	20.2	24.6	20.3	24.9	20.7	26.1	20.4
65–69...	36.4	32.0	36.0	32.3	35.5	30.3	35.3	31.1	36.0	31.1	37.0	29.8
70–74...	58.6	51.9	56.6	50.5	56.4	48.8	57.8	49.9	58.2	50.8	57.2	51.4
75–79...	93.4	86.6	89.9	83.5	87.8	78.4	88.6	80.1	90.6	81.4	92.8	80.8
80–84...	151.3	141.2	150.5	135.6	142.8	131.9	146.7	137.3	149.2	133.1	152.0	136.5
85–89 / 90+ ..	247.9	237.8	234.0	227.9	220.4	209.7	227.5	215.0	227.1	218.1	226.5	222.7

Table 4. 6 (Continued)

MORTALITY RATES

	1938		1939		1940		1941		1942		1943	
	M	F	M	F	M	F	M	F	M	F	M	F
0 ...	71.0	57.0	69.0	53.0	64.0	51.0	68.0	53.0	61.0	49.0	61.0	49.0
5–9 ...	1.8	1.6	1.7	1.4	1.6	1.2	1.7	1.3	1.5	1.2	1.7	1.2
10–14...	1.5	1.2	1.3	1.1	1.2	1.0	1.4	1.0	1.2	0.9	1.3	1.0
15–19...	2.0	1.7	2.0	1.6	2.0	1.5	2.0	1.5	1.9	1.5	2.2	1.4
20–24...	2.5	2.4	2.4	2.1	2.3	2.1	2.6	2.0	2.8	1.9	2.8	2.0
25–29...	2.7	2.7	2.6	2.6	2.4	2.6	2.7	2.5	2.5	2.4	2.4	2.3
30–34...	3.0	3.2	2.8	3.1	2.8	2.8	2.8	2.8	2.7	2.6	2.5	2.5
35–39...	3.7	3.9	3.7	3.8	3.6	3.7	3.8	3.4	3.4	3.3	3.4	3.4
40–44...	5.0	4.6	4.8	4.3	4.9	4.2	5.0	4.5	4.8	4.1	4.9	4.1
45–49...	7.1	5.8	6.7	5.8	6.9	5.7	7.3	6.0	6.9	5.7	7.0	5.7
50–54...	10.4	8.2	10.4	8.5	10.6	8.5	10.6	8.1	10.8	8.0	10.3	8.1
55–59...	15.1	12.3	15.5	12.2	16.3	12.2	16.0	12.3	15.7	12.4	16.1	12.1
60–64...	24.0	19.0	24.0	19.5	24.7	18.4	24.2	18.5	24.1	18.2	24.6	18.6
65–69...	35.8	29.4	37.3	30.4	38.2	30.1	37.3	30.4	36.9	29.3	38.1	29.9
70–74...	57.7	48.6	58.3	49.0	59.3	49.1	58.5	47.0	56.9	45.2	58.8	47.8
75–79...	89.5	78.1	93.6	80.4	91.5	82.7	95.7	79.7	92.7	77.3	94.4	81.8
80–84...	140.0	123.4	141.6	131.0	147.5	127.6	147.6	131.2	140.6	122.8	150.7	134.6
85–89 / 90+ ..	221.5	209.8	242.5	230.9	247.3	231.8	241.9	229.3	232.0	221.6	263.6	237.7

	1944		1945		1946		1947		1948		1949	
	M	F	M	F	M	F	M	F	M	F	M	F
0 ...	62.0	50.0	57.0	47.0	53.0	42.0	52.0	40.0	49.0	39.0	48.0	38.0
5–9 ...	1.6	1.2	1.3	1.0	1.3	1.1	1.2	0.8	1.2	0.7	1.1	0.8
10–14...	1.1	1.0	1.1	0.8	1.1	0.8	1.0	0.7	0.9	0.6	0.9	0.6
15–19...	2.0	1.3	1.8	1.2	1.7	1.3	1.6	1.3	1.5	1.0	1.5	1.0
20–24...	2.2	1.9	2.1	1.6	2.1	1.8	2.0	1.6	2.1	1.4	1.9	1.3
25–29...	2.0	2.2	2.1	1.9	2.0	1.9	2.1	1.7	1.9	1.5	1.9	1.4
30–34...	2.3	2.4	2.2	2.4	2.2	2.1	2.2	2.0	2.1	1.8	2.1	1.7
35–39...	3.1	3.0	3.2	3.0	2.9	2.7	3.1	2.5	3.1	2.5	2.8	2.3
40–44...	4.3	4.0	4.3	3.6	4.4	3.6	4.3	3.3	4.4	3.4	4.1	3.2
45–49...	6.8	5.4	6.8	5.3	6.5	5.3	7.0	4.9	6.8	4.8	6.8	4.7
50–54...	10.0	8.1	10.0	7.7	9.9	7.4	10.1	7.2	10.3	7.3	10.1	7.0
55–59...	15.7	11.6	15.3	11.2	15.3	11.3	15.6	10.6	15.7	10.9	15.3	10.2
60–64...	23.8	18.1	23.8	17.6	23.8	16.7	24.3	17.2	24.7	16.9	25.2	16.9
65–69...	37.5	29.2	36.9	27.2	37.1	27.4	37.1	27.0	36.0	26.3	36.5	26.2
70–74...	57.5	46.6	55.3	45.4	54.0	44.3	54.7	44.0	55.7	43.7	56.2	44.4
75–79...	89.6	76.6	89.6	74.5	86.7	71.9	84.1	71.1	84.8	72.2	82.4	71.5
80–84...	139.7	126.2	136.4	119.2	130.4	119.3	129.5	117.8	130.7	116.7	133.4	113.4
85–89 / 90+ ..	235.1	223.5	236.1	218.6	225.6	213.8	214.2	202.0	215.7	212.2	220.8	206.5

Table 4. 6 (Concluded)

MORTALITY RATES

	1950		1951		1952		1953		1954		1955–60	
	M	F	M	F	M	F	M	F	M	F	M	F
0 ...	46.0	36.0	43.0	39.0	42.0	33.0	40.0	31.0	36.0	28.0	36.0	28.0
5–9 ...	1.0	0.7	1.0	0.7	1.0	0.7	1.0	0.5	0.8	0.5	.84	.54
10–14...	0.8	0.6	0.8	0.5	0.8	0.5	0.8	0.5	0.7	0.4	.71	.43
15–19...	1.3	0.8	1.3	0.9	1.4	0.6	1.4	0.6	1.2	0.6	1.27	.64
20–24...	1.7	1.0	1.9	1.0	1.9	0.9	1.9	0.8	1.7	0.7	1.27	.82
25–29...	1.7	1.2	1.8	1.1	1.8	1.0	1.7	1.0	1.6	0.9	1.80	.96
30–34...	1.9	1.4	2.1	1.5	2.1	1.4	2.0	1.2	1.9	1.2	1.80	1.28
35–39...	2.6	2.2	2.5	2.0	2.6	1.9	2.6	1.8	2.3	1.7	2.38	1.70
40–44...	4.0	3.2	3.9	3.0	3.9	2.8	3.9	2.8	3.6	2.7	3.74	2.53
45–49...	6.6	4.6	6.3	4.5	6.3	4.4	6.2	4.1	5.7	3.9	6.35	4.10
50–54...	10.0	6.6	10.3	6.4	10.6	6.4	10.4	6.4	10.0	6.0	10.0	6.31
55–59...	15.6	10.1	16.2	10.2	16.3	9.6	15.7	9.5	15.1	8.8	15.6	9.30
60–64...	25.1	16.1	24.4	16.1	24.5	15.4	24.2	15.4	24.1	14.5	24.5	15.0
65–69...	36.4	26.4	35.1	24.9	35.6	23.9	35.3	24.3	35.3	23.1	35.0	24.0
70–74...	54.8	42.8	54.5	41.6	52.3	40.4	53.7	39.9	52.0	37.8	53.0	41.0
75–79...	84.8	69.9	87.7	73.3	83.3	66.4	82.4	67.6	79.8	63.4	81.0	67.3
80–84...	132.4	115.3	135.6	120.6	132.6	109.6	129.3	111.0	125.0	103.3	130.0	116.0
85–89 } 90+ } ..	222.5	208.9	234.8	211.9	223.9	204.2	231.9	208.9	227.7	207.7	210.0	180.0
90+ ...											300.0	280.0

	1960–65		1965–70		1970–75		1975–80	
	M	F	M	F	M	F	M	F
0 ...	30.0	23.0	24.0	19.0	20.0	16.0	16.0	13.0
5–9 ...	.68	.42	.56	.32	.45	.25	.37	.19
10–14...	.59	.33	.49	.25	.40	.19	.33	.15
15–19...	1.09	.48	.96	.36	.83	.27	.71	.20
20–24...	1.35	.60	1.16	.45	1.00	.34	.86	.25
25–29...	1.55	.71	1.35	.53	1.17	.39	1.02	.29
30–34...	1.55	.89	1.35	.67	1.17	.51	1.02	.38
35–39...	2.09	1.35	1.83	1.07	1.60	.85	1.40	.68
40–44...	3.42	2.12	3.20	1.77	2.90	1.50	2.76	1.26
45–49...	6.18	3.65	5.85	3.25	5.64	2.90	5.47	2.60
50–54...	9.80	5.75	9.6	5.28	9.4	4.85	9.2	4.44
55–59...	15.4	8.52	15.3	7.90	15.2	7.30	15.1	6.70
60–64...	24.3	14.0	24.1	13.2	24.0	12.3	23.9	11.5
65–69...	34.0	22.5	33.0	21.1	32.3	19.7	31.7	18.4
70–74...	51.2	38.7	49.6	36.9	48.0	35.0	47.0	33.4
75–79...	77.5	64.0	74.0	61.0	71.0	59.0	69.0	55.2
80–84...	125.0	113.0	120.0	108.0	117.0	106.0	112.0	103.0
85–89 } 90+ } ..	205.0	176.0	200.0	172.0	195.0	168.0	191.0	167.0
90+ ...	293.0	273.0	286.0	267.0	279.0	261.0	273.0	255.0

DEFINITION: Deaths in a calendar year per thousand of the population at June 1 in that year.
SOURCE: "Vital Statistics", D.B.S. annual publication, and estimates.

We are entitled to expect particularly striking advances in reducing infant mortality and mortality of young children in the light of the experience of some advanced countries. We have estimated that the infant mortality rate in Canada will fall during the period of the forecast to 13.5 per thousand for males and 11 per thousand for females. The present rate in Sweden is about 18 per thousand for males and females combined, and in New Zealand it is about 20. Presumably, even in Sweden and New Zealand, further improvements may be expected. In Table 4. 3, infant mortality rates for several countries are displayed. As the proportion of children born in hospitals rises, and as further advances in medical knowledge and skill develop, Canadian experience should catch up with experience in countries now more advanced in these respects.

A forecast of death rates can be made with considerably more confidence than a forecast of birth rates or fertility rates, to which we now turn.

Fertility data and assumptions: In Table 4. 7, Canadian fertility rates as experienced and as forecast are set forth. It is not so easy to summarize the history of fertility rates as it is to summarize the history of mortality rates, for the record shows more variation from period to period and from age group to age group. The crude birth rate declined in Canada from 1921 until 1937, after which it rose, hesitatingly at first, until 1943. It then remained comparatively constant for two years, jumped remarkably in 1946 and again in 1947 (on the whole, for fairly obvious reasons), and has remained between 27.1 and 28.7—the levels of about 1922—to the present time. The implication of our forecast of age-specific fertility rates is that the crude birth rate will vary between 24.2 and 25.6 over the period of the forecast. The crude birth rate, of course, reflects changes in the age structure of the population, especially the female population, as well as many other factors affecting age-specific fertility rates.

If we examine the record since 1926 of age-specific fertility rates, we see the following: with the exception of the age group 15-19, in which rates increased to 1930, rates were steady or declined from 1926 to 1930 and all declined from 1930. There was a reversal in the ages below 30 in 1936 or 1937, and in the ages 30 and over around 1941. A distinct acceleration in all rates was noticed around 1945, but since 1948 the pattern has been mixed. The 1954 rates are higher than the 1948 rates for all ages of mother except those over 35. All rates rose from 1953 to 1954 and the rate for

ages	15 - 19	has	been	rising	since	1935
"	20 - 24	"	"	"	"	1950
"	25 - 29	"	"	"	"	1950
"	30 - 34	"	"	"	"	1949
"	35 - 39	"	"	"	"	1951
"	40 - 44	"	"	"	"	1952
"	45 - 49	"	"	"	"	1952

Table 4. 7

FERTILITY RATES

Age of mother / Year	15–19	20–24	25–29	30–34	35–39	40–44	45–49
1926......	29.0	139.9	177.4	153.8	114.6	50.7	6.0
1927......	29.6	140.0	173.6	151.2	113.8	49.4	6.2
1928......	30.2	140.3	172.8	149.9	111.0	48.8	5.9
1929......	30.3	139.9	172.5	144.2	104.8	46.2	5.4
1930......	30.5	143.0	176.0	148.0	106.7	46.6	5.5
1931......	29.9	137.1	175.1	145.3	103.1	44.0	5.5
1932......	28.7	129.6	168.3	140.6	100.5	43.7	5.5
1933......	27.4	117.8	155.6	132.8	94.9	39.3	5.1
1934......	26.2	113.1	151.2	133.1	93.0	39.2	4.9
1935......	26.5	112.5	148.5	128.6	92.6	37.3	4.9
1936......	25.7	112.1	144.3	126.5	90.0	36.3	4.4
1937......	25.6	113.6	142.2	123.4	85.3	34.7	4.2
1938......	26.9	121.2	145.3	123.9	84.8	34.0	4.1
1939......	27.2	119.7	144.0	120.4	83.0	32.6	3.9
1940......	29.3	130.3	152.6	122.8	81.7	32.7	3.7
1941......	30.7	138.4	159.8	122.3	80.0	31.6	3.7
1942......	32.0	145.1	168.7	128.0	83.0	32.3	3.6
1943......	32.1	146.8	175.4	131.9	86.5	31.9	3.5
1944......	31.3	143.3	168.7	134.1	88.1	33.0	3.4
1945......	31.6	143.3	166.8	134.3	90.3	33.5	3.7
1946......	36.5	169.6	191.4	146.0	93.1	34.5	3.8
1947......	42.6	189.1	206.4	150.5	93.1	34.1	3.3
1948......	43.2	181.1	197.6	141.4	89.0	32.6	3.3
1949......	45.2	181.5	201.2	139.7	88.8	31.5	3.2
1950......	45.9	181.1	200.6	141.2	87.8	30.7	3.0
1951......	47.9	188.5	198.7	144.4	86.4	30.8	3.0
1952......	50.7	201.4	204.0	151.5	87.3	30.7	2.8
1953......	52.6	210.0	207.6	154.9	88.1	31.1	2.9
1954......	55.0	219.6	211.3	159.7	88.7	32.4	3.2
1955–60...	55.0	212.0	208.0	155.0	88.0	29.0	2.6
1960–65...	60.0	215.0	208.0	154.0	85.0	27.0	2.4
1965–70...	59.0	215.0	208.0	152.0	80.0	26.0	2.3
1970–75...	58.0	210.0	201.0	150.0	76.0	25.0	2.1
1975–80...	57.0	205.0	198.0	143.0	74.0	24.0	2.0

DEFINITION: Live births in a calendar year per thousand of the female population at June 1 in that year.
SOURCE: "Vital Statistics", D.B.S. annual publication, and estimates.

The great question is: Why are Canadian rates relatively high, and will the factors now causing them to be high operate with equal effect in the next quarter century? The number of women of given age who will have (one or more) children in a given year will depend upon whether they are married and whether they want children; the latter, in turn, depends upon how many they already have and on general economic and social conditions, among other things. The crude marriage rate (number of marriages per thousand of the population) in Canada is shown in Table 4. 8. It will be seen that it rose in 1926 to 1929, fell to a low in 1932, rose to a high again in 1942, fell during the war, reached a peak in 1946 and has been falling since that time. However, the marriage rate in Canada is high relative to that in many other countries, as may be seen from Table 4. 9. Whereas in 1954 the rate in Canada was 8.5 marriages per thousand people, the rate was 7.7 in Eng-

Table 4. 8

CRUDE MARRIAGE RATE IN CANADA

1926	7.0	1936	7.4	1946	10.9
1927	7.2	1937	7.9	1947	10.1
1928	7.5	1938	7.9	1948	9.6
1929	7.7	1939	9.2	1949	9.2
1930	7.0	1940	10.8	1950	9.1
1931	6.4	1941	10.6	1951	9.2
1932	5.9	1942	10.9	1952	8.9
1933	6.0	1943	9.4	1953	8.9
1934	6.8	1944	8.5	1954	8.5
1935	7.1	1945	9.0		

DEFINITION: Marriages in a calendar year per thousand of the population at June 1 in that year
SOURCE: "Vital Statistics", D.B.S. annual publication.

Table 4. 9

CRUDE MARRIAGE RATES, 1954

Canada	8.5	Ireland (Republic)	5.4
United States	9.2	Italy	7.4
Japan	7.9	Netherlands	8.3
Austria	7.8	Norway	7.8
Belgium	7.7	Portugal	8.0
Czechoslovakia	7.9	Spain	8.0
Denmark	7.9	Sweden	7.3
Finland	7.8	Switzerland	7.8
France	7.3	United Kingdom	7.7
Germany (West)	8.6	Yugoslavia	9.9
Greece	8.0	Australia	7.9
Hungary	11.1	New Zealand	8.4

SOURCE: *Demographic Year Book*, 1955, United Nations, Table 30.

land and Wales, 7.3 in France, 8.3 in the Netherlands, and 7.9 in Australia. It was, however, 9.2 in the United States. The present relatively high birth rate in Canada is therefore, in part, a reflection of its relatively high marriage rate. The marriage rate among persons eligible for marriage (persons over 14 and unmarried) is perhaps easier to interpret. Figures are given in Table 4. 10. It will be noted that in the younger age groups, especially under 25, the marriage rate among eligible people rose substantially between 1941 and 1951 in Canada. Though the marriage rate fell in 1954, the pronounced changes were in the 25-44 age group. By and large it appears that more people are marrying and marrying at a younger age.

The number of children per family is subject to a variety of diverse influences. The well-known tendency for the proportion of very large families (with five or more children) to decline continues, but the proportion of families with one to two children increased slightly between 1941 and 1951 (from 41.1% to 43.4%). The average size of family in Canada was 3.9 in

Table 4. 10

MARRIAGE RATES[a] IN CANADA[b] AMONG ELIGIBLE PERSONS

	All Ages		Under 20		20–24		25–29		30–34		35–39		40–44		45–49		50–54		55–59		60–64		65 and over	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1941	64.9	72.1	5.4	45.1	95.5	166.2	168.8	167.8	140.7	102.1	89.5	57.9	56.8	33.2	38.3	21.9	28.1	13.7	20.3	8.4	15.2	6.1	6.4	1.7
1951	72.3	74.7	12.6	65.6	136.0	205.0	177.1	166.9	132.0	98.1	82.3	56.9	56.1	38.4	41.9	27.4	32.6	18.0	27.5	12.1	20.9	7.3	8.9	2.4

	All Ages		15–24		25–44		45–64		65 and over	
	M	F	M	F	M	F	M	F	M	F
1951	72.3	74.7	66	116	132	102	31	16	9	2
1952	71.3	74.5	66	118	128	100	30	16	10	3
1953	72.7	75.7	69	124	128	100	30	16	9	3
1954	70.8	73.7	68	124	123	96	29	16	9	2

a Marriages in a year per thousand unmarried persons over 14 in the population at June 1 in that year.
b Excluding Yukon and Northwest Territories in all years—excluding Newfoundland also in 1941.

SOURCES: Upper Panel: *Demographic Year Book*, 1954, United Nations, Table 33.
Lower Panel: "Vital Statistics" and "Population Estimates by Marital Status Age and Sex for Canada and Provinces", D.B.S., annual publications.

1941, 3.7 in 1951, and at the latest count, stands at 3.8. There is some support for the expectation that the size of family in Canada will continue, on the one hand, to reflect a persistent decrease in very large families and, on the other hand, to reflect some inclination on the part of some parents at the other end of the family size scale to plan slightly larger families.

Decisions to marry and decisions to support or increase a family reflect general economic conditions. Prosperity and the prospect of prosperity encourage marriage and encourage the raising of families, or so the statistics would indicate. This fact is undoubtedly very important in determining the level of Canadian fertility rates. On the other hand, the process of industrialization and urbanization has long been considered to discourage the raising of larger families. This process is still going on in Canada. Other factors may be mentioned in the explanation of the present high birth rate, but it is difficult to assess their importance.[5] Presumably, the addition of immigrants to the population will add to the crude birth rate if only because of the age structure of immigrants. Family allowances, if anything, would be expected to encourage larger families.

Demographers have persistently been surprised by changes in birth rates. In the 1930's, many confidently predicted continuing declines in the birth rates of Western countries. In the 1940's, many argued that the influence of the war on birth rates would be temporary and that the long-term decline would reassert itself. In the 1950's, many are uncertain. As is shown in Table 4. 7 we have forecast that by the end of the forecast period, the fertility rates for all age groups of Canadian women will be falling. The rates for women aged 30 and over are expected to fall throughout the period of the forecast. In the age group 25-29, it is expected that the rate will not rise at all and start to fall at about the middle of the forecast period. In the youngest age groups, the rates are expected to rise slightly in the first half of the period and to fall in the latter half. In all cases, the changes forecast are modest. By and large, we have taken the position that the trend toward earlier marriages and slightly larger, but small, families, will not be arrested for some time. The effects of these trends will be felt most noticeably in the rates for mothers under 30. These forecasts also reflect the assumptions underlying the Commission's work that none of the business recessions of the next quarter century will match in severity the depression of the early '30's.

Net immigration data and assumptions: In the postwar period gross immigration into Canada has never, in any one year, exceeded one half of the gross immigration into Canada in the year of highest immigration in our history. In 1913, 400 thousand immigrants arrived in Canada; in 1951, the best of our postwar years, 195 thousand immigrants arrived. The annual intake of immigrants since 1900 is presented in Table 4. 11. From June 1,

[5]The reader is referred to the paper by Norman B. Ryder, "Components of Canadian Population Growth", *Population Index*, Vol. 20, No. 2, pp. 71-80.

1945 to June 1, 1955, gross immigration averaged 120 thousand per annum, emigration averaged 50 thousand per annum and net immigration averaged 70 thousand, all in round numbers. From June 1, 1951 to June 1, 1955, gross immigration averaged 170 thousand, emigration averaged 60 thousand and net immigration averaged 110 thousand, as may be seen in the balance sheet shown in Table 4. 1. In the year ended June 1, 1955, with emigration estimated at the very low figure of 35 thousand, the net intake was of the order of 100 thousand.

Table 4. 11

GROSS IMMIGRATION, CANADA, 1900-55

(thousands)

1900	41.7	1919	107.7	1938	17.2
1901	55.7	1920	138.8	1939	17.0
1902	89.1	1921	91.7	1940	11.3
1903	138.7	1922	64.2	1941	9.3
1904	131.3	1923	133.7	1942	7.6
1905	141.5	1924	124.2	1943	8.5
1906	211.7	1925	84.9	1944	12.8
1907	272.4	1926	136.0	1945	22.1
1908	143.3	1927	158.9	1946	71.7
1909	173.7	1928	166.8	1947	64.1
1910	286.8	1929	165.0	1948	125.4
1911	331.3	1930	104.5	1949	95.2
1912	375.8	1931	27.5	1950	73.9
1913	400.9	1932	20.6	1951	194.4
1914	150.5	1933	14.4	1952	164.5
1915	36.7	1934	12.5	1953	168.9
1916	55.9	1935	11.3	1954	154.2
1917	72.9	1936	11.6	1955	109.9
1918	41.8	1937	15.1		

SOURCE: Canada Year Book, 1955, D.B.S.

In Table 4. 12 is shown a percentage breakdown of immigration into Canada in each calendar year from 1946 to 1955 by country of origin of the immigrants. It will be noted that the United Kingdom now contributes absolutely and relatively a smaller number of immigrants than in the early part of the postwar period when immigration from the United Kingdom was swollen by the flow of war brides to Canada. Immigration from the United States is about the same. Immigration from Germany and Italy is substantially higher, as is immigration from the Netherlands, though this has fallen dramatically in the last two years. Arrivals from some other European

countries, particularly displaced persons, have also fallen from the high numbers experienced in the middle part of the postwar decade.

The annual net flow of immigrants to Canada in the coming quarter century will depend on government policy both in Canada and abroad, the degree of international tension, the state of the Canadian economy as compared with economic conditions abroad, and social conditions in Canada relative to those in other countries. In making the forecast, we have asked

Table 4. 12

SOURCES OF IMMIGRANTS—GROSS IMMIGRATION

Year	U.K.	U.S.	Germany	Italy	Netherlands	Other	Total
	%	%	%	%	%	%	(000)
1946	70.4	16.0	.5	—	3.1	10.0	72
1947	55.3	14.7	.4	.1	4.3	25.2	64
1948	36.4	5.9	2.0	2.6	5.6	47.5	125
1949	21.8	8.1	3.1	8.1	7.2	51.7	95
1950	17.1	10.6	5.2	12.2	9.7	45.2	74
1951	16.2	4.0	15.0	12.1	9.9	42.8	194
1952	27.5	5.7	15.6	12.6	12.8	24.8	164
1953	27.7	5.6	20.2	14.0	12.0	20.5	169
1954	28.1	6.6	18.5	15.4	10.5	20.9	154
1955	26.7	9.5	16.0	17.4	6.0	24.4	110

SOURCE: Canadian Statistical Review, 1955 Supplement, D.B.S.

ourselves the question: What would be the annual net inflow of immigrants if Canadian government policy with respect to immigration and emigration did not change? One cannot of course be certain. Interest in emigration in many European countries is very sensitive to changes in the degree of international political tension. In some of these countries government policy is becoming somewhat less sympathetic to emigration. At the same time government policies in some receiving countries are giving more encouragement to immigration. It seems plausible that our net loss on exchange of people with the United States will be cut. In the light of these considerations, we deemed it advisable to forecast a range of figures for the annual *net* inflow of immigrants and have selected 50,000 per annum as the low limit of our range, and 100,000 per annum as the upper limit, with 75,000 per annum as the favoured figure.

Table 4. 13

STANDARDIZED AGE-SEX STRUCTURE OF NET INFLOW OF IMMIGRANTS[a]

Age	Male	Female
	%	%
0-4	8.0	9.1
5-9	8.0	8.6
10-14	5.1	5.6
15-19	7.8	7.1
20-24	18.6	17.1
25-29	19.2	17.0
30-34	9.0	10.5
35-39	11.0	8.5
40-44	5.3	4.5
45-49	4.0	4.9
50-54	1.4	1.9
55-59	1.4	2.4
60-64	1.2	2.8
	100.0	100.0

a It is assumed that 55% of the immigrants will be male.

It has been assumed that the age-sex structure of the annual net intake of immigrants will be the same as the average age-sex structure (see Table 4. 13) of the immigrant arrivals in 1953 and 1954 (there are no reliable figures on emigration from Canada by age and by sex). It should also be added that in the absence of adequate information on birth and death rates of immigrants, it has been assumed that the birth rates and the death rates used in forecasting the natural increase of the present population would also be applicable in the forecast of the life history of future batches of immigrants. In extenuation, it may be noted that the birth rates and death rates in Canada reflect to some degree the influence of past immigration into the country.

4. *Forecasts of the Population of Canada*

According to the forecasts resulting from the application of the methods and assumptions cited above, the population of Canada will grow in the next quarter century at a rate between 2% per annum, and 2½% per annum compounded. The population of Canada (apart from the Yukon and the Northwest Territories) will grow from 15.6 million at June 1, 1955, by natural increase to 24 million in 1980. Immigrant arrivals and their natural increase, less emigrants, will add perhaps as much as 3.5 million more to the population total. The population pyramid for 1980 on the assumption that net immigration proceeds at the constant annual rate of 75,000 is shown in Chart 4. 1 and is there compared with the population pyramid of June 1,

Table 4. 14

TOTAL POPULATION OF CANADA[a]

(as at June 1—thousands)

1921	8,776	1939	11,250
1922	8,907	1940	11,364
1923	8,998	1941	11,490
1924	9,131	1942	11,637
1925	9,282	1943	11,778
1926	9,439	1944	11,929
1927	9,624	1945	12,055
1928	9,822	1946	12,268
1929	10,016	1947	12,527
1930	10,195	1948	12,799
1931	10,363	1949[b]	13,423
1932	10,496	1950	13,688
1933	10,619	1951	13,984
1934	10,727	1952	14,405
1935	10,829	1953	14,756
1936	10,934	1954	15,168
1937	11,029	1955	15,573
1938	11,136		

a Yukon and Northwest Territories excluded.
b Newfoundland included from here on.
SOURCE: *Estimated Population by Sex and Age Groups, Canada and Provinces*, Reference Paper No. 40, and Supplements, D.B.S.

1955. It will be noted that the relative shortage of persons between 15-25 in the 1955 population appears in the ages 40-50 in 1980 but, is of course, less pronounced. It will also be noted that in the 1980 population there will be relatively fewer people below 10 years of age, relatively more people between 10 and 30, and over 50, and relatively fewer between 30 and 50 than in the 1955 population. In 1980, there will be some 22% of the population over 50, whereas in 1955 only about 20% of the population was over 50. In this sense, the 1980 population will be a somewhat older population than the 1955 population.

The detailed forecasts are presented in Appendix A, Tables 4A. 1 to 4A. 4. Abbreviated presentation of the results is made in Tables 4. 15 and 4. 16.

Table 4. 15

TOTAL POPULATION OF CANADA

(as at June 1—thousands)

Net Immigration at rate per annum of:	1955	1960	1965	1970	1975	1980
0	15,573	17,090	18,610	20,190	21,960	24,010
50,000	15,573	17,370	19,210	21,160	23,310	25,770
75,000	15,573	17,510	19,520	21,640	23,990	26,650
100,000	15,573	17,650	19,820	21,130	24,660	27,630

Table 4. 16

COMPARATIVE AGE-SEX DISTRIBUTION

POPULATION OF CANADA AS AT JUNE 1 1955 AND 1980

(forecast is based on assumption of net immigration of 75,000 per annum)

	Males				Females				Total			
	(thousands)		%		*(thousands)*		%		*(thousands)*		%	
Age	1955	1980	1955	1980	1955	1980	1955	1980	1955	1980	1955	1980
0–4	1,011.3	1,561.6	12.8	11.6	967.9	1,482.4	12.6	11.2	1,979.2	3,044.0	12.7	11.4
5–9	860.0	1,387.0	10.9	10.3	821.8	1,317.9	10.7	10.0	1,681.8	2,704.9	10.8	10.2
10–14..........	689.2	1,251.3	8.7	9.3	662.9	1,190.6	8.6	9.0	1,352.1	2,441.9	8.7	9.2
15–19..........	574.8	1,152.1	7.3	8.6	553.9	1,110.0	7.2	8.4	1,128.7	2,262.1	7.2	8.5
20–24..........	558.9	1,119.8	7.1	8.3	548.5	1,067.5	7.1	8.1	1,107.4	2,187.3	7.1	8.2
25–29..........	593.3	1,081.9	7.5	8.0	597.2	1,031.3	7.8	7.8	1,190.5	2,113.2	7.6	7.9
30–34..........	562.8	961.3	7.1	7.2	580.7	906.5	7.5	6.9	1,143.5	1,867.8	7.3	7.0
35–39..........	540.6	793.4	6.9	5.9	544.8	751.3	7.1	5.7	1,085.4	1,544.7	7.0	5.8
40–44..........	499.6	691.0	6.3	5.1	486.9	646.4	6.3	4.9	986.5	1,337.4	6.3	5.0
45–49..........	436.6	661.8	5.5	4.9	408.5	632.7	5.3	4.8	845.1	1,294.5	5.4	4.9
50–54..........	373.1	649.4	4.7	4.8	350.3	651.2	4.6	4.9	723.4	1,300.6	4.6	4.9
55–59..........	314.6	562.0	4.0	4.2	306.2	591.8	4.0	4.5	620.8	1,153.8	4.0	4.3
60–64..........	265.7	491.3	3.4	3.7	259.5	530.8	3.4	4.0	525.2	1,022.1	3.4	3.8
65–69..........	231.1	393.1	2.9	2.9	219.2	443.4	2.8	3.4	450.3	836.5	2.9	3.1
70–74..........	180.4	294.6	2.3	2.2	174.7	336.7	2.3	2.5	355.1	631.3	2.3	2.4
75–79..........	112.2	197.3	1.4	1.5	114.5	241.0	1.5	1.8	226.7	438.3	1.5	1.6
80–84..........	54.6	121.1	.7	.9	60.1	159.0	.8	1.2	114.7	280.1	.7	1.1
85–89..........	18.5	59.2	.2	.4	23.6	77.6	.3	.6	42.1	136.8	.3	.5
90+	6.0	22.7	.1	.2	8.5	33.4	.1	.3	14.5	56.1	.1	.2
Total......	7,883.3	13,451.9	100.0	100.0	7,689.7	13,201.5	100.0	100.0	15,573.0	26,653.4	100.0	100.0

5. *Forecasts of Regional Population in Canada*

In Table 4. 17 a summary of the growth of provincial populations in Canada is given.

Table 4. 17

THE POPULATION OF CANADA BY REGIONS

	Canada	Atlantic Provinces	Quebec	Ontario	Prairie Provinces	B.C.	Yukon and N.W.T.
			(thousands)				
1921........	9,039	1,264	2,361	2,934	1,955	525	12
1931........	10,645	1,291	2,874	3,432	2,354	694	13
1941........	11,793	1,433	3,332	3,788	2,422	818	17
1951........	13,984	1,618	4,056	4,598	2,547	1,165	25
			(percentage)				
1921........	100.0	14.0	26.1	32.5	21.6	5.8	—
1931........	100.0	12.0	27.0	32.2	22.2	6.5	—
1941........	100.0	12.2	28.3	32.1	20.5	6.9	—
1951........	100.0	11.6	29.0	32.9	18.1	8.3	—
1951 ÷ 1921........	154.7	128.0	171.8	156.7	130.3	221.9	—

In the 30 years between 1921 and 1951, while the population of Canada rose by some 55%, the population of British Columbia rose by more than 120%, and the population of Quebec rose by a little over 70%. The Ontario population rose at about the same rate as that of all Canada, while the rates for the Atlantic Provinces and Prairie Provinces were below the all-Canada rate, being each about 30%.

The forecasts for 1980, based upon the assumption that net immigration will amount to 75,000 per annum, are shown in Table 4. 18.

Table 4. 18

REGIONAL DISTRIBUTION OF THE POPULATION 1955 AND 1980

(assuming net immigration is 75,000 per annum)

	Canada	Atlantic Provinces	Quebec	Ontario	Prairie Provinces	B.C.
		(thousands)				
1955............	15,573	1,761	4,520	5,183	2,804	1,305
1980............	26,650	2,360	8,010	9,620	4,140	2,520
		(percentage)				
1955............	100.0	11.3	29.0	33.3	18.0	8.4
1980............	100.0	8.9	30.0	36.1	15.5	9.5
1980 ÷ 1955............	171.1	134.0	177.2	185.6	147.6	193.1

Table 4. 19

PROVINCIAL CRUDE BIRTH RATES, DEATH RATES AND RATES OF NATURAL INCREASE

	Rates[a]							Ranks[b]						
	1924	1929	1934	1939	1944	1949	1954	1924	1929	1934	1939	1944	1949	1954
	Birth rates													
Newfoundland	25.6	24.2	23.4	27.5	29.4	35.6	34.3	4	5	3	1	1	1	1
Prince Edward Island	21.6	19.0	21.4	22.6	25.1	30.1	25.9	9	9	5	4	5	3	10
Nova Scotia	22.9	20.8	21.5	21.1	25.5	28.2	28.1	8	7	4	5	4	5	6
New Brunswick	27.4	25.3	24.0	25.2	29.2	32.8	30.4	2	2	2	2	2	2	3
Quebec	34.8	29.4	25.3	24.7	29.2	30.1	30.4	1	1	1	3	2	3	3
Ontario	23.4	20.5	17.6	17.3	19.7	24.3	27.0	7	8	9	9	10	10	7
Manitoba	24.7	21.0	18.8	18.7	22.0	25.5	26.9	5	6	8	8	7	8	8
Saskatchewan	27.2	24.3	21.3	19.9	21.7	26.0	28.5	3	4	7	7	8	7	5
Alberta	24.5	24.7	21.4	21.0	24.0	28.2	32.3	6	3	5	6	6	5	2
British Columbia	17.7	15.7	13.5	15.6	20.4	24.5	26.0	10	10	10	10	9	9	9
Canada	26.7	23.5	20.7	20.6	24.0	27.3	28.7							
	Death rates													
Newfoundland	15.9	14.4	12.1	11.7	12.3	8.3	7.3	1	1	1	2	1	8	8
Prince Edward Island	11.1	12.8	11.4	12.1	10.2	9.8	9.2	5	5	2	1	3	3	2
Nova Scotia	12.8	12.9	11.4	11.3	10.2	9.5	8.5	3	3	2	4	3	5	4
New Brunswick	12.6	12.9	11.0	11.4	11.1	9.6	7.8	4	3	4	3	2	4	6
Quebec	13.0	13.4	10.6	10.3	9.9	8.8	7.6	2	2	5	5	7	7	7
Ontario	10.8	11.4	9.9	10.1	10.0	9.9	8.8	6	6	6	6	6	2	3
Manitoba	8.0	8.6	7.3	8.5	9.2	9.1	8.1	9	9	8	8	8	6	5
Saskatchewan	7.3	7.6	6.4	6.7	7.7	7.9	7.2	10	10	10	10	10	10	9
Alberta	8.1	9.1	7.0	7.4	7.8	8.0	7.2	8	8	9	9	9	9	9
British Columbia	8.8	9.7	8.8	9.5	10.4	10.2	9.8	7	7	7	7	5	1	1
Canada	10.9	11.4	9.5	9.7	9.8	9.2	8.2							
	Rates of natural increase													
Newfoundland	9.7	9.8	11.3	15.8	17.1	27.3	27.0	9	6	6	1	3	1	1
Prince Edward Island	10.5	6.2	10.0	10.5	14.9	20.3	16.7	7	9	8	6	6	4	9
Nova Scotia	10.1	7.9	10.1	9.8	15.3	18.7	19.6	8	8	7	8	5	6	6
New Brunswick	14.8	12.4	13.0	13.8	18.1	23.2	22.6	5	4	4	3	2	2	4
Quebec	21.8	16.0	14.7	14.4	19.3	21.3	22.8	1	2	2	2	1	3	3
Ontario	12.6	9.1	7.7	7.2	9.7	14.4	18.2	6	7	9	9	10	9	8
Manitoba	16.7	12.4	11.5	10.2	12.8	16.4	18.8	3	4	5	7	8	8	7
Saskatchewan	19.9	16.7	14.9	13.2	14.0	18.1	21.3	2	1	1	5	7	7	5
Alberta	16.4	15.6	14.4	13.6	16.2	20.2	25.1	4	3	3	4	4	5	2
British Columbia	8.9	6.0	4.7	6.1	10.0	14.3	16.2	10	10	10	10	9	10	10
Canada	15.8	12.1	11.2	10.9	14.2	18.1	20.5							

[a] Rates are calculated as the number of persons born alive, or dying in a calendar year, per thousand of the population at June 1 in that year.
Source of data on rates: "Vital Statistics", D.B.S., annual publication.

[b] Ranks are calculated by giving highest rate the highest rank, and equal rates equal ranks.

It will be seen that in the 25 years from 1955 to 1980, the Atlantic Provinces and the Prairie Provinces are expected to increase at a rate lower than the all-Canada rate, that the Prairies are expected to increase rather more rapidly than the Maritimes, and that British Columbia will experience the most rapid rate of growth, with Ontario and Quebec ranking next to British Columbia in that order.

The provinces differ rather substantially in their fertility and mortality experience as is apparent in Table 4. 19, which gives comparative experience for recent years. Quebec had the highest birth rate of any province until the late '30's, when first place was yielded to Newfoundland. New Brunswick now has a crude birth rate as high as that of Quebec, though in 1954 the Alberta rate was higher than that of Quebec. Prince Edward Island and British Columbia have the lowest birth rates. Death rates were typically highest in Newfoundland until the '40's, when rather dramatic declines set in. The Prairie Provinces have typically had the lowest death rates. In 1954 the highest rate of natural increase was experienced by Newfoundland, while British Columbia had the lowest. This of course points up the extreme danger of relying on rates of natural increase as a basis for projections of regional population figures in Canada.

We lack, in Canada, good figures on inter-provincial migration. It is possible to make estimates and it is fairly easy to estimate the net gain (loss) of a province from (to) other provinces and countries. But when all is said and done, and after all the information in the record is marshalled, we have to realize that a projection of regional population sizes cannot be more than an informed guess, subject to a wide margin of error. The methods used in the projections presented herein were crude. Lacking knowledge of inter-provincial migration and refined methods of forecasting it, it was felt there would be little point in undertaking detailed forecasts of the natural increase of each region. Rather, a general feeling for the ranking of the provinces by rate of population growth was expressed in the selection of figures for the percentage distribution of the total population in each target year.[6] In making allowances for alternative immigration assumptions, it was assumed that over 50% of immigrants and their natural increase would contribute to the growth of Ontario's population, that the Atlantic Provinces would receive very little increase from this source and that Quebec, the Prairies and British Columbia would share about equally.

The full details of the projections are given in Table 4. 20.

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[6] We paid considerable attention to the forecasts contained in several of the briefs of provincial governments that were presented to the Commission.

Table 4. 20

REGIONAL DISTRIBUTION OF THE POPULATION

Net immigration assumption	1955	1960			1965			1970			1975			1980		
		50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000
								(thousands)								
Atlantic Provinces	1,761	1,880	1,880	1,890	1,990	2,000	2,010	2,100	2,120	2,140	2,220	2,240	2,260	2,330	2,360	2,390
Quebec	4,520	5,100	5,110	5,120	5,730	5,780	5,830	6,360	6,430	6,500	7,050	7,150	7,250	7,880	8,010	8,140
Ontario	5,183	5,860	5,940	6,020	6,570	6,730	6,890	7,320	7,590	7,860	8,170	8,540	8,910	9,140	9,620	10,100
Prairie Provinces	2,804	3,030	3,060	3,080	3,240	3,290	3,340	3,480	3,550	3,630	3,720	3,830	3,940	4,000	4,140	4,280
British Columbia	1,305	1,500	1,520	1,540	1,690	1,720	1,750	1,900	1,950	2,000	2,150	2,230	2,310	2,420	2,520	2,620
Canada	15,573	17,370	17,510	17,650	19,220	19,520	19,820	21,160	21,640	22,130	23,310	23,990	24,670	25,770	26,650	27,530
								(percentage)								
Atlantic Provinces	11.3	10.8	10.7	10.7	10.4	10.2	10.2	9.9	9.8	9.7	9.5	9.4	9.2	9.0	8.9	8.7
Quebec	29.0	29.4	29.2	29.0	29.8	29.6	29.4	30.0	29.7	29.4	30.2	29.8	29.4	30.6	30.0	29.6
Ontario	33.3	33.7	33.9	34.1	34.2	34.5	34.8	34.6	35.1	35.5	35.1	35.6	36.1	35.5	36.1	36.7
Prairie Provinces	18.0	17.4	17.5	17.5	16.8	16.9	16.8	16.5	16.4	16.4	16.0	15.9	16.0	15.5	15.5	15.6
British Columbia	8.4	8.6	8.7	8.7	8.8	8.8	8.8	9.0	9.0	9.0	9.2	9.3	9.4	9.4	9.5	9.5
Canada	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

II. *The Labour Force*

1. *The Forecast of the Total Labour Force*

(i) *Method*

The official definition of the labour force used by the Bureau of Statistics in producing estimates from sample survey data is:

> "The civilian labour force is composed of that portion of the civilian non-institutional population fourteen years of age and over, who, during the survey week did some work; had jobs but did no work; or did not have jobs and were seeking work."[7]

The broad procedure followed was to derive from forecasts of the population, by age and by sex, a forecast of the civilian non-institutional population, and to derive a forecast of the labour force by age and by sex from this in turn by applying predicted labour force membership (participation) rates specific to each sex and each age class.

The steps followed in deriving the civilian non-institutional population from the total population were the following:

1. Estimate the total population 14 years of age and over, by sex. (The population forecasts are for the following age groups: 0-4, 5-9, 10-14, 15-19, etc.) This was done by graphing the cumulative percentage age distributions of the total population for males and females, fitting free-hand curves and reading from the curves the percentage of the total population under 14 years of age.
2. Express the population of each sex in the standard labour force age categories: 14-19, 20-24, 25-44, 45-64 and 65 plus.
3. Estimate the total in the armed forces, assume they are all male, apply an age distribution to this total to obtain the males in the armed forces in each age group. Subtract the males in the armed forces and thus obtain the civilian population aged 14 and over by age and sex.
4. Deduct Indians on reservations from the civilian population after estimating the population of Indians, male and female, by age.
5. Deduct the institutional population after estimating this population by age and by sex.

(ii) *Assumptions*

The Armed Forces: It is the assumption made by this Royal Commission, which we shall not defend here, that the armed forces will not increase beyond their present size of about 120 thousand persons during the period

[7]D.B.S., *The Labour Force*, Reference Paper No. 58, p. 6.

of the forecast. It is also assumed that the number of female members of the services will be so small as to be negligible. The age distribution of the members of the forces is taken to be much the same as now, namely: 14-19, 15%; 20-24, 32%; 25-44, 50%; 45-64, 3%.

Indians on reservations: It is assumed that the total population of Indians living on reservations and aged 14 and over will be constant. The present figure is not known exactly but is presumed to be about 70,000. It is assumed that there will be as many males as females in each age class. In the light of present figures it is further assumed that the age distribution of Indians on reservations will be as follows: 14-19, 21%; 20-24, 14%; 25-44, 36%; 45-64, 20%; 65 and over, 9%.

Institutional population: The proportions of persons male and female 14 years of age and over who will be in hospitals of one kind or another, jails and other institutions, may vary over the years to come, but probably not so widely as significantly to affect the size of the labour force. Consequently, on the basis of current figures, it is assumed that the male institutional population will be constant at about .90% of the total male population 14 years old or more and that the female institutional population will be constant at about .70% of the total female population 14 years old or more. The age distributions of the institutional populations assumed to apply throughout the period of the forecast are:

Age	*Male*	*Female*
14-19	9	8
20-24	8	6
25-44	29	26
45-64	27	25
65 and over	27	35
	100	100

Membership rates: As ultimately, we are interested in computing man-hours of labour contributed annually in productive activity, we project annual average labour force membership rates. The civilian non-institutional population to which these are applied (the derivation of which we have just described), is technically that of June 1 of each year, but this is here interpreted as the average value for the year.

The assumptions as to membership rates are the crucial ones in projecting the labour force; let us therefore consider the record and the forecast in some detail. The record of labour force membership rates by age and sex is not a long one in Canada, going back only to late 1945 when the labour force sample survey was begun.[8] Global rates and rates for all males or all

[8]The ratio of "gainfully occupied" persons to the population by age and by sex may be had from 1921 at least, but this is a substantially different concept.

females may be had for longer periods. Data for the United States are not available for a much longer period, their monthly report on the labour force having been started in 1940, which was also the first year in which information in the decennial census was classified according to modern labour force definitions. In forecasting membership rates, we must be content with guesses in some cases. The data for Canada, deriving from the sample surveys of the labour force, the comparable United States data for a recent year, and the forecasts are arranged in Table 4. 21.

The general questions that arise are the following: Will the proportion of women in the labour force rise? Will membership rates among the youngest and oldest men continue to fall? Surely the rates for males between 25 and 64 can be forecast with considerable confidence; most men of these ages want to work and will continue to want to work. In the age group 65 and over for men, a very sharp drop in the rate has been experienced. This is no doubt a reflection of a general move toward early retirement associated with the secular occupational shifts of the labour force and the more adequate provision of private and state pensions. Since these developments may be expected to continue in the next quarter century, and since the age distribution of men over 65 is expected to become progressively more heavily weighted with men over 75, the rate for men 65 and over may be expected to decline moderately. In the United States the rate for men in this age class is above that in Canada today. In the age group 14-19 for males, the very rapid decline during the last decade reflects the longer schooling of youths and perhaps prosperity generally. There can be no doubt that this rate will fall further, but there are limits to the extent to which the further training of young men will be attempted in schools; in-plant training, night classes and other arrangements may well play an increasing role in supplying men with technical qualifications. We have similarly allowed for some decline in the rate for men in the ages 20-24, but again the estimated decline is a very modest one in the light of the considerations adduced in connection with the age group 14-19.

The forecasts of the rates for women reflect a feeling that, generally speaking, a larger proportion of women will enter the labour force, especially after school age and again after the age of young motherhood. The American figures for women 25 and over are considerably in excess of the Canadian in these age groups. It has not been thought however that the Canadian rates would rise to the levels of present-day American rates; it is difficult to be at all sure in this field but on the whole a conservative view has been adopted of the magnitude of the changes to be expected. One can be considerably more confident of the forecast of *direction* of change of the rates for women over 25. Among younger women, under 25, the problem is even more complicated. One can discern fairly clearly major influences operating in opposite directions. On the one hand, there is the general movement toward greater

Table 4. 21

LABOUR FORCE MEMBERSHIP RATES

		Males					Females				
		14–19	20–24	25–44	45–64	65+	14–19	20–24	25–44	45–64	65+
Canada [a]	1946	60.4	88.8	97.0	93.4	47.5	37.8	48.1	23.2	15.3	5.0
	1947	60.1	90.5	97.4	92.7	44.7	36.7	45.3	23.0	15.4	5.7
	1948	57.9	92.1	97.9	93.1	44.0	33.4	45.4	22.8	16.2	5.0
	1949	58.1	93.5	98.0	93.0	42.9	35.1	46.0	22.9	15.4	4.7
	1950	55.8	93.1	97.4	91.9	40.5	32.9	46.4	22.4	16.4	4.3
	1951	55.2	93.5	97.9	92.1	37.8	34.2	46.8	22.8	17.0	4.0
	1952	55.0	92.6	97.8	91.6	36.4	33.2	47.1	23.3	17.5	4.0
	1953	51.7	92.9	97.6	91.8	34.6	33.1	47.1	23.0	17.2	3.6
	1954	50.1	92.1	97.2	91.3	33.3	33.7	46.6	23.2	18.0	3.7
	1955	48.6	92.3	97.5	91.7	32.4	32.9	46.3	23.7	18.8	3.9
	1960	49.0	91.8	97.5	92.0	32.5	33.0	46.0	25.2	20.0	4.0
	1965	48.2	91.4	97.5	92.0	32.0	32.4	46.0	26.5	21.5	4.0
	1970	47.4	91.0	97.5	92.0	31.5	31.8	46.0	27.8	22.9	4.0
	1975	46.6	90.6	97.5	92.0	31.0	31.2	46.0	29.2	24.3	4.0
	1980	45.8	90.2	97.5	92.0	30.5	30.6	46.0	30.6	25.7	4.0
U.S. [b]	1953	46.5	87.7	98.0	92.8	41.6	30.4	44.3	37.5	35.5	10.0

a Data for 1946-55 are calculated from "The Labour Force", periodical publication of D.B.S.

b U.S. data are from *Current Population Reports*, Series P-57, U.S. Bureau of the Census.

The U.S. data differ from the Canadian in that they include the armed forces and the institutional population is included in the population aged 14 or more.

proportions of women in the labour force. This will affect younger women as well as older, as business careers are more earnestly sought by women. On the other hand the desire for more schooling, for college educations, and for earlier marriage and earlier motherhood will serve to restrict the movement of young women into the labour force. We have supposed that the rate will decline in the age group 14-19 and remain constant in the age group 20-24.

In concluding this discussion, we must repeat that these forecasts of labour force membership rates are guesses. There is room for wide difference of opinion among informed persons because of the lack of longer historical series and because of the complexity and diversity of the factors affecting them. Rather more confidence can be placed however, in the forecasts of the rates for males aged 25 to 64, a group which in 1955, comprised 60% of the total labour force.

(iii) *The forecasts:*

In Table 4. 22[9] the total labour force, by sex, is given by quinquennia to 1980 on the assumptions that net immigration is 50,000, 75,000 and 100,000 per annum over the period of the forecast.

Table 4. 22

LABOUR FORCE SEX DISTRIBUTION

(thousands)

Net immigration	Year	Male	Female	Total
50,000	1955	4,297	1,258	5,555
	1960	4,720	1,430	6,150
	1965	5,190	1,660	6,850
	1970	5,780	1,930	7,710
	1975	6,410	2,200	8,610
	1980	7,090	2,470	9,560
75,000	1955	4,297	1,258	5,555
	1960	4,770	1,440	6,210
	1965	5,290	1,690	6,980
	1970	5,940	1,970	7,910
	1975	6,640	2,260	8,900
	1980	7,380	2,550	9,930
100,000	1955	4,297	1,258	5,555
	1960	4,820	1,450	6,270
	1965	5,390	1,720	7,110
	1970	6,110	2,010	8,120
	1975	6,870	2,320	9,190
	1980	7,670	2,640	10,310

In Table 4. 23, the age distribution of the total labour force is given again by quinquennia to 1980 on the same immigration assumptions.

[9]In Tables 4. 22, 4. 23, 4. 24 and 4. 26 the figure for the average size of the labour force in 1955 is shown as 5,555 thousand whereas the figure now published by D.B.S. is 5,558 thousand. The discrepancy arises because in our computations we used figures for January, 1955 that were subsequently revised.

Table 4. 23

LABOUR FORCE AGE DISTRIBUTION

(thousands)

Net immigration	Years	Ages 14–19	20–24	25–44	45–64	65+	Total
50,000	1955	546	724	2,577	1,497	211	5,555
	1960	690	740	2,750	1,730	240	6,150
	1965	820	900	2,880	1,990	260	6,850
	1970	920	1,140	3,130	2,230	290	7,710
	1975	940	1,340	3,530	2,470	330	8,610
	1980	970	1,410	4,170	2,640	370	9,560
75,000	1955	546	724	2,577	1,497	211	5,555
	1960	690	750	2,790	1,740	240	6,210
	1965	820	910	2,970	2,010	270	6,980
	1970	930	1,160	3,260	2,270	290	7,910
	1975	960	1,360	3,700	2,550	330	8,900
	1980	1,000	1,450	4,360	2,750	370	9,930
100,000	1955	546	724	2,577	1,497	211	5,555
	1960	690	760	2,840	1,740	240	6,270
	1965	830	920	3,060	2,030	270	7,110
	1970	950	1,170	3,390	2,320	290	8,120
	1975	980	1,390	3,860	2,630	330	9,190
	1980	1,020	1,490	4,550	2,870	380	10,310

Finally, in Table 4. 24 age-sex distributions of the civilian non-institutional population aged 14 and over, the number of persons in the labour force, and the number in this population but not in the labour force are given by quinquennia and on the same three assumptions about net immigration.

In conclusion it may be noted that the labour force rises at a slightly more rapid rate than the population (79% as compared with 71% for the median immigration assumption). The proportion of females in the labour force increases from 22.6% to 25.8%. The proportion of the labour force below the age of 25 increases from 22.9% to 24.6%.

2. *The Regional Distribution of the Labour Force*

Forecasting the regional distribution of the labour force is extremely difficult to do confidently. This is partly because the regional forecasts of the population are so uncertain. In addition, data for only a very short span of years are available on a consistent basis; the division of the labour force by regions and by industries and occupations within regions is not available on a current basis, and our ability to forecast the location of industry is modest at best. Thus, again it is necessary to warn that the following estimates are thoughtful guesses but not more than that. An attempt has been made to relate the regional forecasts of the labour force to forecasts of regional economic prospects generally, but this cannot be done in any precise and explicit way, with present-day information and technique.

Table 4. 24

FORECASTS OF THE LABOUR FORCE — NET IMMIGRATION 50,000

(thousands)

		Males						Females						Total Male and Female
		14–19	20–24	25–44	45–64	65+	Total	14–19	20–24	25–44	45–64	65+	Total	
1955	Civ. non-inst. pop. 14+ [a]	672	513	2,111	1,363	583	5,242	666	542	2,187	1,307	580	5,282	10,524
	Membership rate (%)	48.6	92.3	97.5	91.7	32.4		32.9	46.3	23.7	18.8	3.9		
	In labour force	327	473	2,059	1,249	189	4,297	219	251	518	248	22	1,258	5,555
	Not in labour force	345	40	52	114	394	945	447	291	1,669	1,059	558	4,024	4,969
1960	Civ. non-inst. pop. 14+ [a]	860	530	2,220	1,550	660	5,820	810	550	2,300	1,510	680	5,850	11,670
	Membership rate (%)	49.0	91.8	97.5	92.0	32.5		33.0	46.0	25.2	20.0	4.0		
	In labour force	420	490	2,170	1,430	210	4,720	270	250	580	300	30	1,430	6,150
	Not in labour force	440	40	50	120	450	1,100	540	300	1,720	1,210	650	4,420	5,520
1965	Civ. non-inst. pop. 14+ [a]	1,010	650	2,320	1,750	730	6,460	1,020	670	2,350	1,740	800	6,580	13,040
	Membership rate (%)	48.2	91.4	97.5	92.0	32.0		32.4	46.0	26.5	21.5	4.0		
	In labour force	490	600	2,260	1,610	230	5,190	330	300	620	380	30	1,660	6,850
	Not in labour force	520	50	60	140	500	1,270	690	370	1,730	1,360	770	4,920	6,190
1970	Civ. non-inst. pop. 14+ [a]	1,160	830	2,500	1,940	810	7,240	1,160	830	2,480	1,970	910	7,350	14,590
	Membership rate (%)	47.4	91.0	97.5	92.0	31.5		31.8	46.0	27.8	22.9	4.0		
	In labour force	550	750	2,440	1,780	260	5,780	370	380	690	450	40	1,930	7,710
	Not in labour force	610	80	60	160	550	1,460	790	450	1,790	1,520	870	5,420	6,880
1975	Civ. non-inst. pop. 14+ [a]	1,210	980	2,800	2,110	920	8,020	1,210	980	2,740	2,180	1,060	8,170	16,190
	Membership rate (%)	46.6	90.6	97.5	92.0	31.0		31.2	46.0	29.2	24.3	4.0		
	In labour force	560	890	2,740	1,940	280	6,410	380	450	800	530	40	2,200	8,610
	Not in labour force	650	90	60	170	640	1,610	830	530	1,940	1,650	1,020	5,970	7,580
1980	Civ. non-inst. pop. 14+ [a]	1,290	1,040	3,270	2,220	1,050	8,870	1,260	1,030	3,180	2,300	1,250	9,020	17,890
	Membership rate (%)	45.8	90.2	97.5	92.0	30.5		30.6	46.0	30.6	25.7	4.0		
	In labour force	590	940	3,190	2,050	320	7,090	380	480	970	590	50	2,470	9,560
	Not in labour force	700	100	80	170	730	1,780	880	550	2,210	1,710	1,200	6,550	8,330

a Civilian non-institutional population aged 14 and over.

Table 4. 24 (Continued)

FORECASTS OF THE LABOUR FORCE — NET IMMIGRATION 75,000

(thousands)

		Males						Females						Total Male and Female
		14–19	20–24	25–44	45–64	65+	Total	14–19	20–24	25–44	45–64	65+	Total	
1955	Civ. non-inst. pop. 14+ [a]	672	513	2,111	1,363	583	5,242	666	542	2,187	1,307	580	5,282	10,524
	Membership rate (%)	48.6	92.3	97.5	91.7	32.4		32.9	46.3	23.7	18.8	3.9		
	In labour force	327	473	2,059	1,249	189	4,297	219	251	518	248	22	1,258	5,555
	Not in labour force	345	40	52	114	394	945	447	291	1,669	1,059	558	4,024	4,969
1960	Civ. non-inst. pop. 14+ [a]	860	540	2,260	1,560	660	5,880	810	560	2,320	1,510	690	5,890	11,770
	Membership rate (%)	49.0	91.8	97.5	92.0	32.5		33.0	46.0	25.2	20.0	4.0		
	In labour force	420	500	2,210	1,430	210	4,770	270	260	580	300	30	1,440	6,210
	Not in labour force	440	40	50	130	450	1,110	540	300	1,740	1,210	660	4,450	5,560
1965	Civ. non-inst. pop. 14+ [a]	1,020	660	2,390	1,770	730	6,570	1,030	670	2,410	1,760	800	6,670	13,240
	Membership rate (%)	48.2	91.4	97.5	92.0	32.0		32.4	46.0	26.5	21.5	4.0		
	In labour force	490	610	2,330	1,630	230	5,290	330	310	640	380	30	1,690	6,980
	Not in labour force	530	50	60	140	500	1,280	700	360	1,770	1,380	770	4,980	6,260
1970	Civ. non-inst. pop. 14+ [a]	1,180	840	2,600	1,980	820	7,420	1,180	840	2,570	2,000	920	7,510	14,930
	Membership rate (%)	47.4	91.0	97.5	92.0	31.5		31.8	46.0	27.8	22.9	4.0		
	In labour force	560	770	2,530	1,820	260	5,940	370	390	710	460	40	1,970	7,910
	Not in labour force	620	70	70	160	560	1,480	810	450	1,860	1,540	880	5,540	7,020
1975	Civ. non-inst. pop. 14+ [a]	1,230	1,000	2,940	2,180	930	8,280	1,250	990	2,840	2,240	1,070	8,390	16,670
	Membership rate (%)	46.6	90.6	97.5	92.0	31.0		31.2	46.0	29.2	24.3	4.0		
	In labour force	570	900	2,870	2,010	290	6,640	390	460	830	540	40	2,260	8,900
	Not in labour force	660	100	70	170	640	1,640	860	530	2,010	1,700	1,030	6,130	7,770
1980	Civ. non-inst. pop. 14+ [a]	1,310	1,070	3,430	2,330	1,060	9,200	1,300	1,060	3,310	2,380	1,260	9,310	18,510
	Membership rate (%)	45.8	90.2	97.5	92.0	30.5		30.6	46.0	30.6	25.7	4.0		
	In labour force	600	970	3,350	2,140	320	7,380	400	480	1,010	610	50	2,550	9,930
	Not in labour force	710	100	80	190	740	1,820	900	580	2,300	1,770	1,210	6,760	8,580

[a] Civilian non-institutional population aged 14 and over.

Table 4. 24 (Concluded)

FORECASTS OF THE LABOUR FORCE — NET IMMIGRATION 100,000

(thousands)

		Males						Females						Total Males and Females
		14–19	20–24	25–44	45–64	65+	Total	14–19	20–24	25–44	45–64	65+	Total	
1955	Civ. non-inst. pop. 14+ [a]	672	513	2,111	1,363	583	5,242	666	542	2,187	1,307	580	5,282	10,524
	Membership rate (%)	48.6	92.3	97.5	91.7	32.4		32.9	46.3	23.7	18.8	3.9		
	In labour force	327	473	2,059	1,249	189	4,297	219	251	518	248	22	1,258	5,555
	Not in labour force	345	40	52	114	394	945	447	291	1,669	1,059	558	4,024	4,969
1960	Civ. non-inst. pop. 14+ [a]	860	540	2,300	1,570	660	5,930	810	560	2,350	1,520	690	5,930	11,860
	Membership rate (%)	49.0	91.8	97.5	92.0	32.5		33.0	46.0	25.2	20.0	4.0		
	In labour force	420	500	2,250	1,440	210	4,820	270	260	590	300	30	1,450	6,270
	Not in labour force	440	40	50	130	450	1,110	540	300	1,760	1,220	660	4,480	5,590
1965	Civ. non-inst. pop. 14+ [a]	1,020	670	2,470	1,790	730	6,680	1,040	680	2,470	1,780	800	6,770	13,450
	Membership rate (%)	48.2	91.4	97.5	92.0	32.0		32.4	46.0	26.5	21.5	4.0		
	In labour force	490	610	2,410	1,650	230	5,390	340	310	660	380	30	1,720	7,110
	Not in labour force	530	60	60	140	500	1,290	700	370	1,810	1,400	770	5,050	6,340
1970	Civ. non-inst. pop. 14+ [a]	1,190	860	2,720	2,010	820	7,600	1,200	850	2,650	2,040	930	7,670	15,270
	Membership rate (%)	47.4	91.0	97.5	92.0	31.5		31.8	46.0	27.8	22.9	4.0		
	In labour force	560	780	2,650	1,860	260	6,110	380	390	730	470	40	2,010	8,120
	Not in labour force	630	80	70	150	560	1,490	820	460	1,920	1,570	890	5,660	7,150
1975	Civ. non-inst. pop. 14+ [a]	1,250	1,020	3,080	2,250	930	8,530	1,280	1,010	2,940	2,300	1,080	8,610	17,140
	Membership rate (%)	46.6	90.6	97.5	92.0	31.0		31.2	46.0	29.2	24.3	4.0		
	In labour force	580	930	3,000	2,070	290	6,870	400	460	860	560	40	2,320	9,190
	Not in labour force	670	90	80	180	640	1,660	880	550	2,080	1,740	1,040	6,290	7,950
1980	Civ. non-inst. pop. 14+ [a]	1,330	1,100	3,590	2,440	1,070	9,530	1,340	1,080	3,430	2,470	1,280	9,600	19,130
	Membership rate (%)	45.8	90.2	97.5	92.0	30.5		30.6	46.0	30.6	25.7	4.0		
	In labour force	610	990	3,500	2,240	330	7,670	410	500	1,050	630	50	2,640	10,310
	Not in labour force	720	110	90	200	740	1,860	930	580	2,380	1,840	1,230	6,960	8,820

a Civilian non-institutional population aged 14 and over.

In Table 4. 25, the labour force (average size over the year) as a percentage of the total population (at June 1 of that year) for selected past years and for the years of the forecast period is given.

Table 4. 25

THE LABOUR FORCE[a] AS A PERCENTAGE OF THE TOTAL POPULATION[b]

Region	1946	1951	1955	1960	1965	1970	1975	1980
Atlantic Provinces[c]	35.2	31.8	29.4	29.2	29.2	29.7	29.8	30.0
Quebec	36.8	36.0	35.1	34.8	35.1	35.8	36.1	36.2
Ontario	41.6	40.6	39.1	38.9	39.2	40.0	40.6	40.7
Prairie Provinces	41.0	37.2	34.7	34.5	34.5	35.3	36.0	36.1
British Columbia	40.5	36.9	34.6	34.5	34.5	35.3	36.0	36.2
Canada	39.4	37.3	35.7	35.5	35.8	36.7	37.1	37.3

a Average size for the year.
b As at June 1. Forecasts are based on assumption of net immigration of 75,000 per annum.
c Excludes Newfoundland in 1946.

It will be seen that while the percentage of the population in the labour force declined from 1946 to 1955, it is expected to climb very slowly after the first quinquennium in the period of the forecast. This ratio is of course a very crude forecasting tool as it is so sensitive to changes in age-sex distributions as well as more fundamental factors affecting decisions to work and look for work. Broadly speaking the same pattern of movement in each of the ratios has been forecast for each of the main regions.

In Table 4.26, the forecast of the regional distribution of the labour force is presented. Just as in 1955 Ontario was the only one of the five regions considered whose share of the country's labour force exceeded its share of the country's population, so in 1980, Ontario is the only region with this characteristic; indeed the Ontario share of both the population and labour force of the country in 1980 is expected to be greater than in 1955.

Table 4. 26

REGIONAL DISTRIBUTION OF THE LABOUR FORCE

Net immigration assumption	1955	1960			1965			1970			1975			1980		
		50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000
								(thousands)								
Atlantic Provinces	518	550	550	550	580	580	590	620	630	630	660	670	670	700	710	720
Quebec	1,586	1,770	1,770	1,780	2,010	2,030	2,050	2,280	2,300	2,340	2,540	2,580	2,630	2,840	2,900	2,960
Ontario	2,025	2,270	2,310	2,350	2,560	2,640	2,710	2,910	3,040	3,160	3,310	3,470	3,640	3,710	3,920	4,130
Prairie Provinces	974	1,040	1,050	1,060	1,120	1,140	1,160	1,230	1,250	1,280	1,330	1,380	1,420	1,440	1,490	1,550
British Columbia	452	520	530	530	580	590	600	670	690	710	770	800	830	870	910	950
Canada	5,555	6,150	6,210	6,270	6,850	6,980	7,110	7,710	7,910	8,120	8,610	8,900	9,910	9,560	9,930	10,310
								(percentage)								
Atlantic Provinces	9.3		8.9			8.3			8.0			7.5			7.1	
Quebec	28.6		28.5			29.1			29.1			29.0			29.2	
Ontario	36.5		37.2			37.8			38.4			39.0			39.5	
Prairie Provinces	17.5		16.9			16.3			15.8			15.5			15.0	
British Columbia	8.1		8.5			8.5			8.7			9.0			9.2	
Canada	100.0		100.0			100.0			100.0			100.0			100.0	

5

THE GROSS NATIONAL PRODUCT AND THE GROSS DOMESTIC PRODUCT

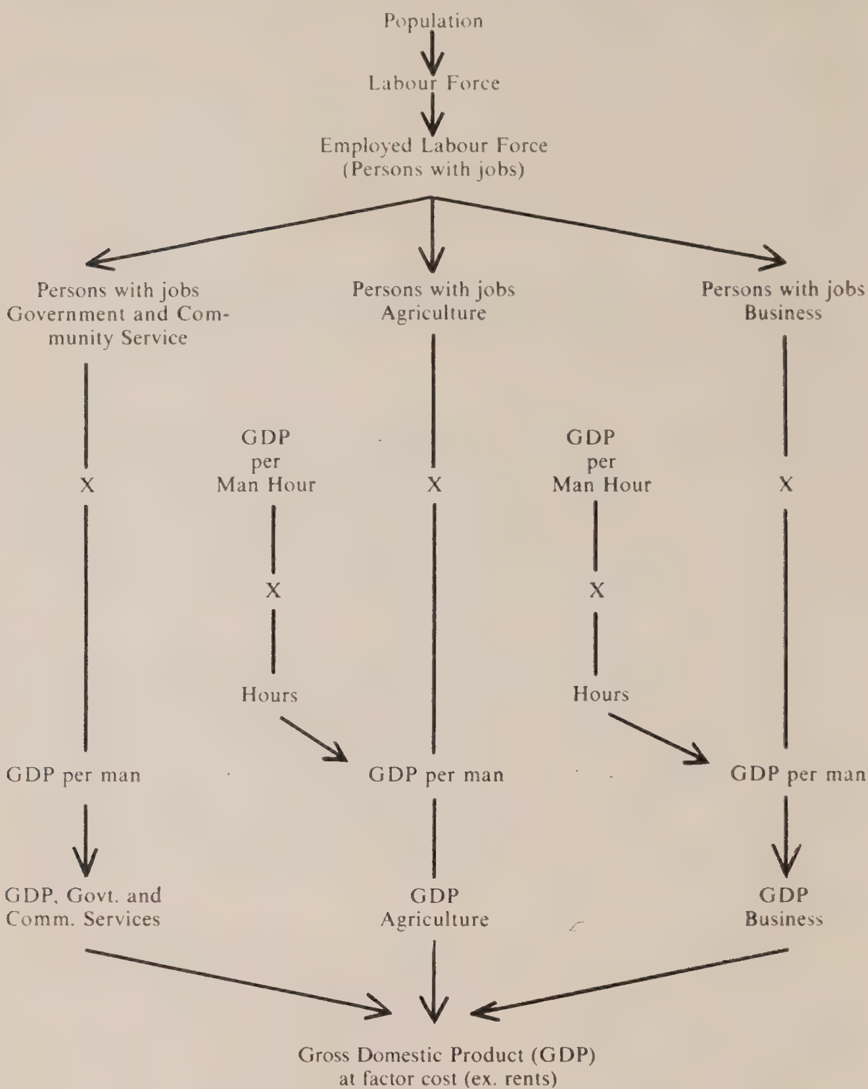
I. *Introduction*

The description and analysis of Chapters 2 and 3 led to the selection of the general method of forecasting the Gross National Product that has been used in this study. In this chapter this general approach will be explained more fully, and the detail of the historical record and assumptions upon which the forecasts are based will be stated and discussed. The forecasts will be presented at the end of the chapter.

The essential plan of the forecasting procedure is simple and easily stated. One starts with the labour force projections derived from the population forecasts in Chapter 4. From this, one estimates the employed labour force, or the persons with jobs, and then proceeds to estimate the division of the employed labour force among three main sectors of the economy, namely, the sector in which the work of government and community service is carried on, the sector in which agriculture is pursued and, finally, the so-called business sector in which all other employment is found. These steps are explained in Part II below.

The next stage is to forecast the output (valued in 1949 dollars) that one can expect on the average from each man employed in each sector. These figures of output per man can then be multiplied by the number of men employed in the corresponding sectors to yield forecasts of output for each sector. When these are added together and a few technical adjustments made, the result is the forecast of the G.N.P. This description is of course very much oversimplified. In making forecasts of employment and output for each sector, study was made of the historical record in as detailed a breakdown as could be made available. Moreover, in the agriculture and business sectors, annual output per man was considered in the form output per man-hour times average hours worked per week times the number of weeks per year. Productivity—output per man-hour—and average hours worked per week were studied separately, forecasts of each made, and the forecast of annual output per man derived from them. This stage is described in Part V.

FORECASTING THE GROSS NATIONAL PRODUCT



plus rents
= GDP at factor cost
plus indirect taxes
= GDP at market prices
plus interest and dividends and the like
received from abroad minus interest and
dividends and the like paid abroad
= GROSS NATIONAL PRODUCT (GNP)

(X denotes multiplication)

This general scheme is set out in the preceding diagram. It will be seen that the measure of output used for each sector is its contribution to Gross Domestic Product at factor cost—a concept used already in Chapter 2 and explained much more fully in Part II of this chapter. The adjustments required to convert the total of sectoral contributions to G.D.P. to G.N.P. are listed at the bottom of the diagram; these also will be explained below in Part VI.

II. *The Division of the Labour Force*

The first division of the labour force that was necessary was the division into persons with jobs (the employed labour force) and the remainder. The principle followed is easily explained. We decided to attempt to forecast what the G.N.P. in any given year would be if the same proportion of the labour force were employed on the average through the year as was actually employed on an average from 1951 through 1955, namely 97%. Thus the employed labour force for each year of the forecast was taken to be 97% of the total labour force.

The next stage was the division of the employed labour force by sectors of the economy. This distribution is not entirely clear in the historical record. Work has been done in attempting to improve the record in this respect and we shall report on this before advancing to a description of the methods and assumptions underlying the forecast of the division. In Table 5. 1 we present our own estimates of the number of persons employed in each of three main sectors of the economy: agriculture, business, and civilian government and community services, and also the percentage distribution of the total persons with jobs across these three sectors of the economy. The description of the sources of these figures may be found in Appendix B.

The division of the labour force, the record of which is shown in Table 5. 1, we forecast by the following procedure: we first made a forecast of employment in the government and community services sector, by methods we will describe more fully below, and then forecast the number of persons with jobs in the agricultural sector of the economy. The forecast of the number of persons employed in the business sector of the economy was then obtained as the difference between the forecast of the total employed labour force and the two forecasts just mentioned.

The government and community services sector was, for the purposes of forecasting employment, considered to be divided into the following sub-sectors:

The field of health
University education
Other education, including religion
Miscellaneous community services
Municipal, federal and provincial governments.

Table 5. 1

DISTRIBUTION OF THE EMPLOYED LABOUR FORCE

	(thousands of persons)				*(percentage)*		
	Agri-culture	Business	Civilian govt. and community services	Total	Agri-culture	Business	Civilian govt. and community services
1926	1,181	1,953	247	3,381	34.9	57.8	7.3
1927	1,209	2,060	255	3,524	34.3	58.5	7.2
1928	1,225	2,189	264	3,678	33.3	59.5	7.2
1929	1,224	2,329	269	3,822	32.0	60.9	7.0
1930	1,160	2,275	283	3,718	31.2	61.2	7.6
1931	1,140	2,121	294	3,555	32.1	59.7	8.3
1932	1,159	1,890	299	3,348	34.6	56.5	8.9
1933	1,178	1,915	292	3,385	34.8	56.6	8.6
1934	1,197	2,083	302	3,582	33.4	58.2	8.4
1935	1,217	2,156	304	3,677	33.1	58.6	8.3
1936	1,236	2,282	309	3,827	32.3	59.6	8.1
1937	1,255	2,446	302	4,003	31.4	61.1	7.5
1938	1,274	2,329	318	3,921	32.5	59.4	8.1
1939	1,293	2,370	318	3,981	32.5	59.5	8.0
1940	1,259	2,535	325	4,122	30.5	61.5	7.9
1941	1,147	2,674	336	4,157	27.6	64.3	8.1
1942	1,068	2,950	348	4,366	24.5	67.6	8.0
1943	1,049	3,003	360	4,412	23.8	68.1	8.2
1944	1,067	2,984	384	4,435	24.1	67.3	8.7
1945	1,075	2,878	404	4,357	24.7	66.1	9.3
1946	1,186	3,064	437	4,687	25.3	65.4	9.3
1947	1,122	3,261	461	4,844	23.2	67.3	9.5
1948	1,096	3,305	485	4,886	22.4	67.6	9.9
1949	1,079	3,362	507	4,948	21.8	67.9	10.2
1950	1,018	3,446	532	4,996	20.4	69.0	10.6
1951	940	3,615	556	5,111	18.4	70.7	10.9
1952	887	3,707	579	5,173	17.1	71.7	11.2
1953	858	3,785	603	5,246	16.4	72.2	11.5
1954	873	3,694	627	5,194	16.8	71.1	12.1
1955	817	3,847	664	5,328	15.3	72.2	12.5

For description of sources of these estimates see Appendix B of this chapter.

Health: In Table 5. 2 we present the record of the number of persons employed in the field of health since 1926. It will be noted that the figures increased gradually during the 1930's and from 1946 until 1954 there was a further substantial increase, so that the 1954 figure is almost double the figure for 1946. The ratio of employment in the field of health to the total population has risen since 1931 from about .6% to approximately 1.25% in 1955. It is expected that this ratio will continue to rise during the period of the forecast to about 2% in 1980. In general, our expectation—based upon the studies of social capital expenditures—is that the physically and mentally ill will be rather more adequately provided for. The hospital beds per thousand of the population for the physically ill are estimated to be about 5.7

and it is thought that this may rise by 1980 to 7.1 or 7.2. For the mentally ill there are now about 3.5 beds per thousand of the population and it is expected that employment per bed in the mental hospitals will rise modestly over the period of the forecast to improve the present condition of understaffing of these institutions. Employment per bed in all other kinds of hospitals is expected to remain at its present level. It is, thus, the combination of the rise in beds per head of the population and the very slight increase in employment per bed that accounts for our forecast of the increase in the ratio of persons employed in hospitals to the population.

Table 5. 2

PERSONS EMPLOYED IN THE FIELD OF HEALTH, 1926 TO 1955

	Number of persons employed (full-time only) *(thousands)*		Number of persons employed (full-time only) *(thousands)*
1926	61	1940	88
1927	63	1941	90[a]
1928	63	1942	91
1929	63	1943	86
		1944	99
1930	66		
1931	68[a]	1945	102
1932	72	1946	113
1933	73	1947	122
1934	76	1948	129
		1949	139
1935	77		
1936	81	1950	150
1937	73	1951	157[a]
1938	82	1952	158
1939	83	1953	170
		1954	180
		1955	191

a Census figure.
For sources and methods see Appendix B of this chapter.

Other persons employed in the field of health such as doctors, dentists, chiropractors, and so forth, are expected in total to comprise about the same percentage of the population as today. And thus our expectation of a rise in the ratio of persons employed in the field of health to the population is based wholly on the expectation of a rise in the ratio of persons employed in hospitals to the population. It is expected that employment in the field of health will rise from 190,000 in 1955 to about 550,000 in 1980.

Universities: The volume of full-time employment in universities for selected years between 1926 and 1955 is shown in Table 5. 3. Non-teaching employees in univeristies are thought to be about one and a half times the number of full-time teachers.

The forecast of employment for universities is based on the forecast of the number of students who will be attending universities. This forecast of

the number of students is explained in the Commission's study of requirements for social capital.[1] The ratio of students to teachers is expected to rise from something in the order of 11 to 15, in consequence of the extreme pressures on the universities that will inevitably be associated with the surge of students they must admit. The ratio of teaching personnel to non-teaching personnel in universities is expected to remain constant. The forecast of students multiplied by the teacher-student ratio and this in turn multiplied by the ratio of the total university employment to teachers yields the forecast of employment in universities. On this basis employment in the universities is expected to rise from 18,000 in 1955 to 55,000 in 1980.

Table 5. 3

FULL-TIME EMPLOYMENT IN CANADIAN UNIVERSITIES 1926 TO 1955, SELECTED YEARS

(thousands)

1926	6	1945	10
1930	9	1950	15
1935	11	1955	18
1940	9		

Schools: The forecast of employment in non-university education and in religious activities is also based on a forecast of the number of students, the ratio of students to teachers, and the ratio of teachers to total employment in the sub-sector. As in the case of university students, the forecast of non-university students that was used is the one described in the social capital study. The student-teacher ratio is expected to increase from about 27 to about 32—again because of the enormous influx of students in the school system that must be anticipated. The ratio of total employment in non-university education and religious activities to teachers in this field is expected to decline from its present 178 to 168. This expected decline is to be accounted for partly by a decline in the ratio of persons engaged in religious activities to non-university teachers, and partly by a failure of administrative and maintenance personnel in non-university education to rise as rapidly as the number of teachers.

Miscellaneous community services: These embrace welfare institutions, trade and labour organizations, and a few other service organizations. Employment in these services accounted for .64% of the total labour force in the 1951 census. This figure was higher in 1951 than in previous census years; it was .38% in 1931. It is expected that a further increase in this proportion will be experienced so that by 1980 it will reach .80%. We have therefore forecast that the absolute volume of employment in miscellaneous community services will increase from the present 42,000 to 80,000 in 1980.

[1]*Housing and Social Capital.*

Government employment: Government employment by federal, provincial and municipal governments, as defined for purposes of this study is shown in Table 5. 4.

Table 5. 4

EMPLOYMENT BY FEDERAL, PROVINCIAL AND MUNICIPAL GOVERNMENTS 1926 TO 1955

(thousands)

1926	58	1935	74	1945	135
1927	61	1936	74	1946	150
1928	66	1937	76	1947	155
1929	68	1938	82	1948	163
		1939	80	1949	168
1930	74				
1931	79	1940	81	1950	173
1932	77	1941	90	1951	180
1933	69	1942	100	1952	194
1934	75	1943	115	1953	195
		1944	123	1954	200
				1955	215

It should be noted carefully that while these figures include employees of the post office, they do not include any employees of Crown corporations. Moreover, employees of federal and provincial hospitals have been classified as employees in the health field. There are many other examples of employees often thought or considered to be employees of the government who have, in this study, been classified as employees of other sectors of the economy.

Municipal employees have almost doubled in number since 1926, even though the employees here referred to do not include persons engaged by municipal enterprises such as waterworks, municipal hydro commissions or telephone companies.

For the study of social capital an estimate was made of the number of people who were expected in 1980 to be residing in groups of municipalities classified by size. Since it was found that in each size group the ratio of municipal employment to population had not changed significantly between the early 1930's and the early 1950's, the averages of these ratios for these dates were applied to the projections of urban populations for 1980. This procedure yielded a figure for municipal employment in 1980 of 157,000, which is to be compared with the figure of just under 70,000 in 1955.

Employment in the two senior levels of government, as here defined, has increased by almost two-thirds in the last decade. The ratio of this employment to population has changed from 7.3 per thousand in 1945 to 9.4 per thousand in 1955. In the postwar decade, federal government employment increased by some 19%, whereas employment in provincial governments rose over 60%. In the early postwar period in the federal government

field, there was a substitution of employees on the civilian side of government administration for employees responsible for administering the war economy, so that the expansion of the federal government services was retarded. In the provincial government services, the situation was rather different; the ending of the war permitted an expansion of activities which had been delayed during years of depression and the war.

It is of course very difficult to forecast the extent to which the activity of the nation will be administered directly by government departments. We have, in recent years, experienced a rather rapid expansion of various social services; moreover, since about 1948 the civilian corps supporting the armed forces has more than tripled. The effect of the introduction of new data-processing machinery will probably restrict the expansion in the clerical ranks of the civil services, but, on the other hand, the expansion of the professional ranks will probably exceed that of the service as a whole.

Unless there is a fundamental change in the tasks of government in Canada, the most likely forecast would seem to be that the number of federal and provincial government employees per thousand of the population will not fall but rather rise modestly. We have forecast that this figure will rise from 9.4 in 1955 to 11.6 in 1980. This implies that the number of federal and provincial government employees will rise at the rate of 3% p.a.p.a. from about 150,000 to 310,000. The population, it will be recalled, is expected to increase at about 2.2% p.a.p.a. (if net immigration is at the rate of 75,000 per annum).

For the civilian government and community services sector as a whole, the implications of our detailed forecasts are that employment will increase from some 665,000 in 1955 to approximately 1,450,000 in 1980. As a proportion of the total of persons with jobs in the whole economy, employment in this sector will rise from 12.5% in 1955 to 14.5% in 1980 (the 1980 figures quoted above, are, as usual, based on the assumption of net immigration at the rate of 75,000 per annum).

It remains now to describe the assumptions underlying the forecast of the division of employment in the industrial sector of the economy as between agriculture and business. In Table 5. 1, the number of persons with jobs in agriculture is shown to have declined since 1939 at a very rapid rate. This decline has been associated with the increased use of machinery on farms, which, in turn, has permitted an expansion of the average size of farm. The hired man and the family worker left farms at equal rates until 1951 and thereafter unpaid family workers continued to leave the farm though the hired labour force remained almost steady. Thus, we have been able in recent years to produce more food with an absolutely smaller agricultural labour force. This phenomenon, which is dealt with at greater length in the Commission's study of agriculture,[2] is expected to continue through

[2]*Progress and Prospects of Canadian Agriculture.*

part at least of the period of the forecast. These agricultural studies suggest that the labour force in agriculture will continue to decline, though at a diminishing rate, throughout the period between now and 1980. We shall not enter into an elaborate defence of this forecast here, but will refer the reader to the analysis of prospects for agriculture in the special study of agriculture prepared for the Commission. Employment in agriculture which in 1955 averaged about 820,000 for the year, will, by 1980, be about 100,000 lower. The implication is that the ratio of agricultural employment to total civilian persons with jobs which has decreased almost continuously since 1926 will decrease further from its present level of 15.3 to approximately 7.5% in 1980.

Employment in the business sector of the economy is expected to rise from its present 3,850,000 to 7,460,000 by 1980. As noted above, this forecast has been obtained residually.

III. *Hours of Work*

As explained at the beginning of this chapter, a crucial link in the forecast of output in the agricultural sector and the business sector was a forecast of hours worked per man per week on the average. In Table 5. 5 are presented the historical series on the average hours worked per week per man in Canada in each of these two sectors, together with figures for the United States with which they may be compared. In Appendix C a brief resumé of the sources of the figures on hours worked per week in Canada is given. A warning should be offered however that these data have been pieced together from fragmentary source material, are almost certainly incorrect indicators of absolute values and are probably only fair indicators of the trend of the values. In thinking about the figures, it should be remembered that they represent averages of the hours of work of all employees including those who work overtime as well as those who work part time. It so happens that average hours worked per man per year have declined at about the same rate in agriculture as they have in business, according to our estimates. If our estimates are reasonable indicators of changes in hours worked, then the differential between agriculture and business has remained a fairly constant proportion of the hours worked in business. There is some reason to suppose that this relative differential might well continue to be the same. Agricultural hours are longer than those in business and shorter hours being a rather common goal, one might suppose that hours worked in agriculture might diminish more rapidly than in business. On the other hand, the adoption of mechanical aids on the farm cannot entirely prevent nature from imposing her timetable on the farmer. With these thoughts in mind, in the absence of much further information and on the advice of the economists preparing the Commission's special studies in agriculture, we have predicted that hours of work in agriculture will continue to decline at the same rate

Table 5. 5

AVERAGE WEEKLY HOURS WORKED PER MAN

	Canada		United States	
	Agriculture	Business	Agriculture[a]	Manufacturing[b]
1926	64.0	49.8	—	45.0
1927	64.0	49.7	—	45.0
1928	63.0	49.6	—	44.4
1929	63.0	49.8	—	44.2
1930	62.0	48.2	—	42.1
1931	62.0	—	—	40.5
1932	61.0	—	—	38.3
1933	61.0	—	—	38.1
1934	60.0	—	—	34.6
1935	60.0	—	—	36.6
1936	59.0	—	—	39.2
1937	59.0	—	—	38.6
1938	58.0	—	—	35.6
1939	59.4	—	—	37.7
1940	60.5	—	—	38.1
1941	61.9	—	—	40.6
1942	63.3	—	—	42.9
1943	62.8	—	—	44.9
1944	62.2	—	—	45.2
1945	58.4	44.0	—	43.4
1946	55.4	42.6	—	40.4
1947	53.0	42.4	52.9	40.4
1948	53.7	42.0	52.5	40.1
1949	52.6	42.1	53.3	39.2
1950	51.8	42.3	50.1	40.5
1951	52.7	42.1	52.6	40.7
1952	53.8	41.8	50.9	40.7
1953	54.8	41.7	50.0	40.5
1954	55.1	41.0	49.3	39.7
1955	55.3	41.3	49.5	—

a Persons at work in agriculture by average hours worked during the survey week: May, 1947 to May, 1955.

SOURCE: Bureau of the Census, Current Population Reports, Labor Force Series, P-50, No. 63, *Hours of Work in the U.S., 1955.*

b Average weekly hours, excluding overtime, for production workers in manufacturing industries.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Statistical Abstract of the United States,* 1955, p. 212 and Historical Statistics of the United States 1789-1945, Series D, pp. 117-120.

as hours of work in the business sector of the economy. In the business sector, the forecast is a simple one, namely, that hours will continue to decline at the same rate of decrease that has been experienced since 1926. Thus, average hours per week per man in agriculture are predicted to fall from 55.3 in 1955 to 43.75 in 1980 and, in business, to fall from 41.3 in 1955 to 34.3 in 1980.

IV. *Output—The Record*

To produce forecasts of output according to the procedure indicated in the diagram on page 00, we need to combine forecasts of output per man or output per man-hour with the forecasts of employment and hours of work

given in Parts II and III above. However, in making forecasts of productivity we shall want to examine the record of productivity. This cannot be completed until we have presented the record of output. In this part we shall discuss the historical record of output in the main sectors of the economy. There are several ways in which the output of the Canadian economy may be measured; we shall first describe these and then explain why we have decided to use the measure known as Gross Domestic Product at factor cost. In Part V we shall give a summary of the record of productivity, our forecasts of productivity and our forecasts of output.

1. *Alternative Measures of Output—Definitions*

(i) *National income by industry*

In the official D.B.S. publications: *National Accounts — Income and Expenditure,* estimates of national income by industry for 13 industries of the economy are provided. The concept of national income is probably the most familiar of all the measures of output, being widely used both in Canada and the United States. The contribution of each industry to national income is reckoned by adding together the rewards of the factors of production employed in that industry. Output as measured by national income excludes indirect taxes on the products produced by the industry, subsidies received by the industry and, by convention, depreciation on capital employed in the industry.

In calculating national income by industry, it is desired in principle to regard the fundamental economic unit as the establishment, and for purposes of allocating most components of income, it is possible to regard the establishment as the fundamental unit. However, in cases of enterprises consisting of many establishments, the basic accounting documents of the enterprises do not usually permit the allocation of profits by establishments and, therefore, in those cases in which the establishments of an enterprise are in different industries, the profits of all are credited to the industry to which the head office or the largest establishment belongs. For this reason, there is probably an understatement of the income of extractive industries and an overstatement of the incomes of manufacturing industries in this measurement of output as an industry's contribution to national income.

(ii) *Net value added as defined in the census of industry*

In the annual census of industry in Canada, the output of manufacturing industries is defined as the difference between the value at current market prices of the goods and services produced in the current period, less the value of the raw materials, fuel and power used, measured at current costs. Thus, the measure of output in the Canadian census of industry is essentially a measure of the value added to the materials and power used in the industry

by the application of labour, entrepreneurship, capital and a few services. Net value added includes depreciation and also the value of the services of advertising, insurance and transport purchased by establishments in the industry. This measure of output reflects current prices.

(iii) *The index of industrial production*

Indexes of industrial production have been published for Canada for the period 1935 to date for mining, power and manufacturing production. The objective of the index of industrial production is to measure, in constant prices, the change in the output of an industry, output being conceived as the difference between the value (apart from excise taxes and subsidies) of goods or services produced and materials, fuel, power *and* the services of advertising, insurance and transportation purchased. Thus, conceptually, indexes of industrial production measure changes in output defined to include depreciation and to exclude indirect taxes, subsidies and services, as well as materials purchased from other industries. In practice, it is not possible to exclude services purchased from other industries in this way, as basic data are lacking.[3] In addition, it is not possible to obtain for all industries in each year direct measurements of output as it is defined above. In such cases it has been necessary to use as indicators, measures of gross output or materials used, or, in some cases, man-hours of input. An exposition of the methods by which the indexes of industrial production are constructed may be found in the D.B.S. Reference Paper No. 34 already referred to.

2. *Alternative Measures of Output—Characteristics*

In this section, we shall review the three alternative measures of output described in the previous section with respect to a few important characteristics.

(i) *Coverage*

Ideally, any measure of output should supply information for a fairly detailed breakdown of industries. This means, among other things, that information must be sufficiently complete that it is not necessary to attribute movements in the output of one industry to another industry. This also means that there should be a clear distinction between the outputs of the various industries, and between income and output (especially as output must all be produced domestically, whereas income generated by productive activity may partly be paid to foreigners). The output of an industry as measured by its contribution to national income does not measure up fully to this ideal. For example, pulp and paper profits are allocated partly to the output of

[3] "Owing to the absence of a breakdown by individual industries of the cost of business services, it was necessary *within each major group* to limit our measurement to (census) 'value added' in constant prices", Revised Index of Industrial Production 1935 to 1951, D.B.S. Reference Paper No. 34, p. 13.

the forestry industry; the output of the mining industry reflects, in some degree, profits from smelting ore. Finally, the industrial contributions to national income as published in Canada are available only for rather broad sectors of the economy; for example, no breakdown of the manufacturing sector is provided. Output measures defined as net value added (according to the census of industry) are available for a rather fine breakdown of parts of the economy, but for other parts of the economy they are not available at all. Moreover, this measure of an industry's output does not accurately represent the changing use of services supplied by other industries.

Indexes of industrial production are available for a very large number of manufacturing and mining industries but there are no indexes of production published for some sectors of the economy. Although conceptually this measure would adequately reflect an industry's changing use of services, in practice it does not because of the limitation of data available for use both as weights and as indicators of change in output.

(ii) *Sensitivity to price changes*

It is desirable that a measure of output be insensitive to changes in the general price level. Otherwise, a fall in the value of money might be mistakenly reckoned as a growth in output. Thus, measures of output should be stated either in physical units or in constant dollars. Industrial contributions to national income are, as we have stated, measures of output in terms of income. It is almost as difficult in practice as it is in theory to deflate a series of income figures. Presumably it would not make much sense to seek to measure output with series of income figures corrected for changes in the prices of goods a consumer buys. On the other hand, if we seek to deflate figures of income received by each factor of production, we find that while we have rather obvious deflators—wage and salary rates—for the income of wage earners and salary earners, the selection of deflators for profits, rent rates and interest receipts is much more difficult.

Net value added, as defined in the census of industry, measures output in current dollars. It is almost impossible to correct this measure for price change as it includes a complex of incomes, depreciation and payments for other business services.

The index of industrial production, conceptually, is independent of changes in the levels of prices since its weights are the prices prevailing in the base period. This measurement of industrial output is affected by the changing structure of prices, however, since products with relatively high unit prices in the base year get correspondingly high weights in the index.

(iii) *Treatment of indirect taxation*

Whether the measure of an industry's output should vary directly with indirect taxes and inversely with subsidies depends on where it is thought

that the burden of taxation falls. If it is thought that indirect taxes are paid by the industry on whose products taxes are levied out of the earnings of that industry from production, then, presumably, measures of that industry's output should reflect changes in indirect taxes. If, on the other hand, it is thought that indirect taxes are paid by the purchasers of an industry's product, it might be argued that the measure of output should not reflect changes in indirect taxes. The matter is complicated, however, as economists have never been confident of their analysis of the incidence of taxation. Moreover, indirect taxes include a great variety of taxes, such as excise taxes, property taxes, sales taxes and revenues from Crown lands.

All three measures of output considered above are independent of indirect taxes and subsidies.

(iv) *Treatment of depreciation*

If depreciation were a good measure of the using up of capital in production, there would probably be much to be said for defining output so as to exclude the depreciation of capital in the same way we define it so as to exclude the use of materials. However, the measures of depreciation available to us are arbitrary, partly because depreciation is sometimes measured by the rules laid down by the income tax authorities and partly because its measurement in any event must be, to some extent, an accounting convention. Measures of depreciation for income tax purposes generally have higher value than that of the true loss of capital each year, and, in addition, some industries receive favoured treatment by the income tax authorities as they are allowed to charge higher rates of depreciation than other industries. Because of this arbitrariness in the available information, it seems desirable that in measuring output no distinction between depreciation and profit should be drawn but that the two items should be treated as one. Of the three measures of output referred to above, only industrial contribution to national income separates depreciation from profit.

(v) *Treatment of inventory profits and losses*

Profits and losses on inventories are not to be regarded as output. However, when the output of an industry is measured by its contribution to national income, profits for the industry will include inventory profits (or losses) unless a specific inventory valuation adjustment is made. Only for grain stocks has such an adjustment been made in the figures of industrial contributions to G.N.P. published by the D.B.S. No adjustments have been made in respect of other inventories.

Net value added as defined by the census of industry, does not in principle require an inventory valuation adjustment, but it does require one in practice. In principle, establishments are requested to file information on materials used (rather than bought) and on goods produced (rather than

sold). In fact, establishments do not always adhere precisely to the instructions, and, to the extent that they do not, an inventory valuation adjustment should be made.[4]

Insofar as the index of industrial production is based on information derived from the census of industry, the same observation applies to this measure to output. Both the measure of net value added and the index of industrial production should make an allowance for the change in unfinished goods in process during the year. On this aspect of adjustment for inventories, see D.B.S. Reference Paper No. 34, page 23.

(vi) *Summary*

In brief, output as measured by industrial contributions to national income is inadequate for our purposes because it is almost impossible to express it in constant dollars and because it is not available in fine industrial breakdown. In addition, the exclusion of charges for depreciation from national income by industry, while defensible in principle, is not perfectly satisfactory in practice because of the quality of the estimates of these charges. Finally, this measure suffers from the need for adjustment of profits to exclude profits and losses on inventories.

The measure of output provided by net value added is also inadequate for our purposes. The measure uses current prices and is, therefore, highly sensitive to changes in the prices of particular commodities.

The indexes of industrial production are available for a very fine breakdown of some sectors of the economy, are in many respects independent of the price level, and treat profits and depreciation similarly. No indexes of production are available for some sectors of the economy and some indexes of production fail to take proper account of the purchases of business services. Nevertheless, the indexes of industrial production are the best of the three measures of output so far discussed and a very considerable use of these indexes was made in estimating output according to the measure we selected and which we shall now describe.

3. *The Gross Domestic Product at Factor Cost* (G.D.P.)

D.B.S., in connection with its study of the inputs and outputs of Canadian industries in 1949, produced for 1949 measures of the outputs of industries which are, in fact, different from all three of the measures described above.[5] These measures we shall refer to as individual contributions to Gross Domestic Product at factor cost.

[4]Since 1952, establishments have been asked to file information on the value of factory shipments (rather than goods produced) so that an inventory valuation adjustment is now required in principle.

[5]*The Inter-Industry Flow of Goods and Services, Canada, 1949*, D.B.S. Reference Paper No. 72, 1956.

An industry's contribution to the G.D.P. in any year is defined as the returns to the factors of production employed in that industry in Canada (even though the recipients of these returns may live abroad) including depreciation with profits and excluding purchases of business services from other industries, indirect taxes and subsidies, and receipts by Canadians for productive services rendered abroad.

The G.D.P. was available as a by-product of the Bureau's input-output study for 1949 for each of 50 industries. G.D.P. figures in this study for 1949 are either the same as are published in *The Inter-Industry Flow of Goods and Services, Canada, 1949,* or are combinations or breakdowns of estimates appearing there. The reader may consult this D.B.S. publication for detail on the construction of these estimates for 1949.[6]

We shall mention two cases in which we have re-allocated estimates appearing in the Bureau's publication. In the input-output study, an attempt was made to include all construction activity in the construction industry, even that done in other industries by employees of those other industries. In the estimates included in this study, we have attempted to allocate construction undertaken by, for example, the employees of mining and transportation industries to those industries. The other re-allocation concerns the finance, insurance and real estate industry. Most of the product of this industry fits into one or two categories, either rents (paid by other industries and residential occupants) or the remuneration of factors by this industry. The concept adopted here of the output of this industry is that it consists of the remuneration of factors employed in this industry, while rents paid by, or imputed to, tenants should be allocated to the industries using the occupied property. Some other re-allocations have been made but they are relatively minor compared with the two we have mentioned explicitly. The re-allocations do not change the total G.D.P. for the whole economy; this remains at $14,779.9 million. This figure may be obtained from the published G.N.P. for that year by adding to it net income paid to foreigners (approximately $307 million) and deducting from it an inventory valuation adjustment (approximately $158 million), and indirect taxes, less subsidies (approximately $1,830 million).

Having chosen this measure of industrial output for 1949, it was necessary to produce the comparable measures for the other years in the period 1926 to 1955. Briefly, the method was to multiply the 1949 G.D.P. figures for each industry by an index number of production for that industry with 1949 as its base to obtain its G.D.P. in any year. Index numbers used were, for the most part, supplied by the Business Statistics Section of D.B.S. For

[6]It should be pointed out, however, that for the year 1949, there is an inventory valuation adjustment in the G.D.P. figures while there is none (except for grain) for the industrial contributions to national income.

mining, manufacturing, and the utilities industries, the indexes are substantially the same as the published indexes of industrial production based on the average for the years 1935 to 1939.

The reliability of these annual indexes is described fully in D.B.S. Reference Paper No. 34 on the Index of Industrial Production. For industries other than mining, manufacturing and utilities, no published indexes were available. We have been fortunate in obtaining access to worksheets and some preliminary unpublished indicators from D.B.S. which are of a tentative nature and which must be revised, and in some cases radically altered, before publication. We recognize the dangers inherent in combining the published and the preliminary revised (and unpublished) indicators. We, of course, take full responsibility for the results.

Quarterly indexes have been prepared for all sectors of the economy since 1949 which are, as far as possible, similar in their calculation and concept to those in the published indexes. However, we have been forced to employ a variety of miscellaneous indicators for the years prior to 1949 because of the absence of systematically collected data for those years.

It should be emphasized that in addition to the difficulties described above of interpreting the indexes of industrial production, we have added a new one: the internal weight for many of the published indexes pertains to the period 1935 to 1939, whereas the weighting of each industry index, *relative to other industries* in the present G.D.P. estimates, pertains to 1949. At the very least, this complicates the understanding of the G.D.P. series. At worst, the use of 1935 to 1939 weights leads to overemphasis on rapidly growing industries that are now putting out products at lower relative prices than in the base year. The indexes of industrial production that we have used measure net output when possible. When data are scanty, it is sometimes necessary to base the index on gross output, including the change in the use of materials per unit of output. If the industry in question produces more goods per unit of materials, the use of gross indicators will tend to understate the growth of output, but if, as in agriculture and many extractive industries, there is an increasing use of materials per unit of output, gross indicators will tend to overstate the growth of output. In Appendix D, these and other biases are discussed in more detail.

In the trades, services and construction industries, and in the activities of government and of providing residential housing, the concept of production or of value added becomes very shadowy both in the measurement of the Gross National Expenditure and the measurement of G.D.P. Recourse must be had to simple reckoning of factor rewards on the assumption that the change in the value of output is approximately equal to the change in the sum of wages and salaries. Where there are different grades of employees

or services (for example in the armed forces, and, in a slightly different sense, in the post office) it is possible to give some indication of improvements of efficiency by noting the different proportion of employees or services in the different categories in successive years. This device, however, can only approximate such improvement in service or efficiency. Consequently, it is likely that the G.D.P. estimates derived here for sectors I to V correspond much more accurately to the concept of production than do the estimates for sectors VI to VIII.

We shall now describe the sectors into which the 50-odd industries have been combined. There is a fairly obvious sort of logic in the combinations of industries and the sectors correspond fairly closely to the division of labour in the Commission's study of the economy. The sectors are as follows:

I. Agriculture

This sector is not differentiated either as to region or as to type of farming.

II. Resource Industries

This sector covers forestry, fishing and hunting, mining (including exploration and prospecting) and electric power (including its distribution) but excludes other utilities.

III. Primary Manufacturing

This sector covers the following industries in the Commission's primary manufacturing category:

In the food and beverage group: canning and processing, dairy products, grain mill products and meat products.

In the wood products group: saw and planing mills.

In the paper products group: pulp and paper.

In the non-ferrous metal products group: non-ferrous metal, smelting and refining.

In the non-metallic mineral products group: abrasives (artificial) and cement (hydraulic).

In the chemicals and allied products group: acids, alkalis and salts, fertilizers, and primary plastics.

IV. Secondary Manufacturing

This sector covers the industries in the Commission's secondary manufacturing category, and consists of all manufacturing groups and sub-groups not in primary manufacturing. In particular, it covers the primary iron and steel industry, and the petroleum and natural gas industry (exclusive of field operations and pipelines).

V. Transport, Storage and Communication

This sector covers organizations suggested by its title including the C.B.C. and C.N.R., but omits the Post Office, which is in VII.

VI. Trades, Services and Construction

This sector covers the construction *industry* (not all construction *activity,* however), gas utilities and waterworks, finance, insurance and real estate. Wholesale trade is covered but, unfortunately, it is carried on the retail trade indicator. The finance, insurance and real estate industry estimate is confined to the remuneration of factors working in the industry, and *excludes the rent of premises or property used by other sectors.*

VII. Government and Community Services

This sector includes public works department construction. It also includes the output of the post office, the services of schools and hospitals, and the medical profession, the remuneration of the civil service and the armed forces.

VIII. Rents for Residential Housing

The services of residential housing are regarded as productive activity and their value as measured by rents paid or imputed to the owners of the property are included in the G.D.P.

Further details on the sources and methods used in the measurement of G.D.P. by industry are to be found in Appendix E.

In Table 5. 6, the G.D.P. estimates for the agricultural, business and government and community services sectors of the economy together with residential rents are presented for the period 1926 to 1955. In Appendix F more detailed estimates may be found. An even finer breakdown of G.D.P. for the manufacturing sector of the economy may be found in the Commission study *Canadian Secondary Manufacturing Industry.*

Table 5. 6

GROSS DOMESTIC PRODUCT BY SECTORS
1926 TO 1955

	(millions of 1949 dollars)					(percentage)			
	Agriculture	Business	Government and community services	Residential rents	Total	Agriculture	Business	Government and community services	Residential rents
1926	2,031.6	4,981.5	715.2	345.4	8,073.7	25.2	61.7	8.9	4.3
1927	2,151.0	5,361.2	754.2	361.3	8,627.7	24.9	62.1	8.7	4.2
1928	2,258.1	5,900.3	786.3	372.4	9,317.1	24.2	63.3	8.4	4.0
1929	1,612.5	6,138.1	822.2	386.0	8,958.8	18.0	68.5	9.2	4.3
1930	1,952.1	5,622.0	861.5	390.9	8,826.5	22.1	63.7	9.8	4.4
1931	1,633.9	4,981.6	869.5	394.0	7,879.0	20.7	63.2	11.0	5.0
1932	1,955.2	4,245.5	837.9	392.7	7,431.3	26.3	57.1	11.3	5.3
1933	1,413.6	4,084.0	783.9	396.4	6,677.9	21.2	61.2	11.7	5.9
1934	1,536.0	4,542.8	815.7	407.5	7,302.0	21.0	62.2	11.2	5.6
1935	1,670.6	4,853.9	831.4	418.5	7,774.4	21.5	62.4	10.7	5.4
1936	1,528.7	5,304.3	844.7	424.1	8,102.8	18.9	65.5	10.4	5.2
1937	1,485.2	5,952.6	896.3	432.1	8,766.2	16.9	67.9	10.2	4.9
1938	1,888.2	5,567.9	952.8	437.0	8,845.9	21.3	62.9	10.8	4.9
1939	2,183.4	5,884.1	1,005.0	444.4	9,516.9	22.9	61.8	10.6	4.7
1940	2,240.1	6,863.8	1,335.8	452.3	10,892.0	20.6	63.0	12.3	4.2
1941	1,903.4	8,145.7	1,869.0	412.8	12,380.9	15.4	65.8	15.1	3.3
1942	2,841.8	9,119.2	2,288.4	475.7	14,725.1	19.3	61.9	15.1	3.2
1943	1,910.9	9,615.4	2,862.9	487.4	14,876.6	12.8	64.6	19.2	3.3
1944	2,355.5	9,806.1	3,057.1	498.4	15,717.1	15.0	62.4	19.5	3.2
1945	1,782.3	9,315.8	2,830.8	508.3	14,437.2	12.3	64.5	19.6	3.5
1946	1,969.6	9,370.9	1,633.9	522.4	13,496.8	14.6	69.4	12.1	3.9
1947	1,827.7	10,101.5	1,469.0	537.2	13,935.4	13.1	72.5	10.5	3.9
1948	1,958.2	10,402.3	1,500.5	570.3	14,431.3	13.6	72.1	10.4	4.0
1949	1,892.0	10,703.2	1,570.1	614.6	14,779.1	12.8	72.4	10.6	4.2
1950	2,085.0	11,335.0	1,646.7	652.7	15,719.4	13.3	72.1	10.5	4.2
1951	2,338.5	11,946.7	1,755.2	690.2	16,730.6	14.0	71.4	10.5	4.1
1952	2,544.7	12,495.3	1,881.4	714.8	17,636.2	14.4	70.9	10.7	4.1
1953	2,406.6	13,207.6	1,977.9	749.2	18,341.3	13.1	72.0	10.8	4.1
1954	1,916.6	13,042.4	2,059.4	787.3	17,805.7	10.8	73.2	11.6	4.4
1955	2,342.3	14,091.8	2,132.6	823.6	19,390.3	12.1	72.7	11.0	4.2

V. *Output—The Forecasts by Main Sectors*

In this part, we give a summary of the recent history of changes in productivity, forecasts of productivity and forecasts of output according to the divisions into sectors just made.

1. *Output in the Agricultural Sector*

Our forecast of output in the agricultural sector has been made by multiplying the expected number of workers in agriculture by the average number of hours each is expected to work per year and by multiplying this in turn by the productivity of agricultural labour as measured by G.D.P. in agriculture per man-hour.

We have described the forecast of agricultural employment in Part II of this chapter and the forecast of average weekly hours per man in Part III. We must now describe the forecast of the productivity of agricultural labour. In Table 5. 7 we present figures of the productivity of agricultural labour in Canada and the United States. The rate of increase of the productivity of agricultural labour is shown in Table 5. 8 for selected periods for Canada and the United States. Figures of productivity in agriculture are extremely sensitive to changes in the size of crops. Part at least of the phenomenal rate of increase of G.D.P. per man-hour in Canadian agriculture in the postwar period is to be attributed to the very large crops, especially grain crops, that we have enjoyed in several seasons. No small part of the increase in agricultural productivity must be attributed to the mechanization of farming that has advanced so remarkably in the postwar decade. It may be supposed with some confidence that the mechanizing of farms will now advance at a slightly less rapid rate. Productivity in agriculture also reflects the composition of agricultural output. There will be changes in the "basket" of goods produced by Canadian farmers; wheat production will probably remain at about its present average amount, whereas production of meat, vegetables and dairy products may be expected to expand. Though the factors affecting productivity have divergent effects, it is our feeling that agricultural productivity will experience a decline in its rate of increase and we have forecast, therefore, that it will rise at 3% p.a.p.a. from 1955 until 1970, and from then on at 2.5% p.a.p.a.[7] On this assumption and on the assumptions made earlier concerning employment and hours of work in agriculture, we have predicted that agricultural output as measured by G.D.P. in this industry will rise from $2,340 million of 1949 dollars in 1955 to $2,910 million of 1949 dollars in 1980. In Table 5. 9 we present a summary of the factors underlying the forecast of agricultural output.

[7]It should be noted that the 1955 figure used in the calculations was not the actual figure experienced in that year, namely, $0.99, but rather $0.87, which is the 1955 figure on a line of trend of agricultural productivity. It so happens that $0.87 is also the average of the actual figures for agricultural productivity in 1954 and 1955.

Table 5. 7

OUTPUT PER MAN-HOUR, AGRICULTURE

	Canada: G.D.P. at factor cost, 1949 Canadian dollars	United States: G.N.P. at market prices, 1953 U.S. dollars
1910	—	.667
1911	—	.626
1912	—	.712
1913	—	.643
1914	—	.662
1915	—	.763
1916	—	.675
1917	—	.693
1918	—	.647
1919	—	.682
1920	—	.659
1921	—	.670
1922	—	.690
1923	—	.719
1924	—	.682
1925	—	.718
1926	.52	.699
1927	.53	.773
1928	.56	.718
1929	.40	.746
1930	.52	.703
1931	.44	.786
1932	.53	.779
1933	.38	.761
1934	.41	.703
1935	.44	.815
1936	.40	.730
1937	.39	.837
1938	.49	.913
1939	.55	.903
1940	.56	.902
1941	.51	.990
1942	.81	1.048
1943	.56	.986
1944	.68	1.000
1945	.55	1.031
1946	.58	1.098
1947	.59	1.091
1948	.64	1.263
1949	.64	1.259
1950	.76	1.434
1951	.91	1.327
1952	1.02	1.362
1953	.98	1.437
1954	.76	
1955	.99	

SOURCE: The Canadian rates are derived from data prepared for the Commission. See Appendix F of this chapter.

The United States rates are based on estimates prepared by John W. Kendrick of the National Bureau of Economic Research as revised for the Joint Committee of the U.S. Congress on the Economic Report.

Table 5. 8

RATES OF GROWTH OF OUTPUT PER MAN-HOUR, AGRICULTURE

	1926-47	1926-53	1947-53	1949-53	1949-55
Canada	.60	2.37	8.82	11.23	7.54
United States	2.14	2.70	4.70	3.36	—

Table 5. 9

THE FORECAST OF AGRICULTURAL OUTPUT[a]

(based on the assumption of net immigration of 75,000 per annum)

	1955	1965	1970	1975	1980
Employment	1.00	.93	.91	.906	.90
Average weekly hours per man	1.00	.88	.85	.82	.79
G.D.P. per man-hour	1.00	1.18	1.37	1.55	1.75
G.D.P.[b]	1.00	.97	1.06	1.15	1.24

a Index numbers based on 1955.

b The product of the first three index numbers in a column does not necessarily equal the last because of rounding.

2. *Output in the Business Sector*

We have described earlier our predictions of employment and average weekly hours per man in the business sector of the economy. These predictions were that employment would about double, while weekly hours would fall about 20%. We turn our attention now to productivity in the business sector as measured by G.D.P. at factor cost per man-hour of labour employed.

The figures from 1926 that we have available are given in Table 5. 10 together with figures for the United States with which they may be compared (though the definitions vary somewhat).

In Chapter 3 we offered some theoretical speculations concerning movements in output per man-hour. Here, it is necessary, with these theoretical notions in mind, to attempt to forecast the actual dollars and cents worth (1949 dollars) of G.D.P. to be produced by an average man-hour of effort in each of the forecast years. A difference of five cents in the forecast can have a very large effect on the forecast of output in the business sector. Moreover, the data in the historical records are known to be weak, and to be weaker for earlier periods than for recent ones. It follows that the prediction of the level of output per man-hour is extremely hazardous. Indeed, at this point we come face to face with the fact that it is almost impossible to forecast the nation's output. However, if one studies the comparative rates of

Table 5. 10

OUTPUT PER MAN-HOUR, PRIVATE BUSINESS SECTOR

	Canada: G.D.P. at factor cost 1949 Canadian dollars	United States: G.N.P. at market prices 1953 U.S. dollars
1910	—	1.190
1911	—	1.220
1912	—	1.285
1913	—	1.276
1914	—	1.290
1915	—	1.233
1916	—	1.268
1917	—	1.226
1918	—	1.244
1919	—	1.367
1920	—	1.381
1921	—	1.366
1922	—	1.474
1923	—	1.530
1924	—	1.583
1925	—	1.657
1926	.98	1.673
1927	1.00	1.649
1928	1.04	1.666
1929	1.02	1.678
1930	.98	1.649
1931	—	1.709
1932	—	1.650
1933	—	1.620
1934	—	1.777
1935	—	1.884
1936	—	1.935
1937	—	1.974
1938	—	2.013
1939	—	2.072
1940	—	2.166
1941	—	2.240
1942	—	2.218
1943	—	2.245
1944	—	2.410
1945	1.41	2.486
1946	1.38	2.346
1947	1.40	2.303
1948	1.44	2.386
1949	1.45	2.478
1950	1.49	2.627
1951	1.51	2.652
1952	1.55	2.721
1953	1.61	2.804
1954	1.65	
1955	1.70	

SOURCE: The Canadian rates are derived from estimates of G.D.P. employment and hours prepared by the Commission and described here.

The U.S. rates are based on estimates by John W. Kendrick of the National Bureau of Economic Research as revised for the Joint Committee of the U.S. Congress on the Economic Report.

change in Table 5. 11, a few significant facts and interpretations stand out. In the first place, the range of average compounded rates of change is not unmanageably wide. For the Canadian figures in this table, this range is between 1.71% p.a.p.a. and 3.24% p.a.p.a; the range in the figures for the

Table 5. 11

RATES OF GROWTH OF OUTPUT PER MAN-HOUR, PRIVATE BUSINESS SECTOR

(per cent per annum per annum)

	Canada	United States
1910 to 1926	—	2.15
1929	—	1.82
1939	—	1.93
1941	—	2.06
1947	—	1.80
1949	—	1.90
1950	—	2.00
1951	—	1.97
1953	—	2.01
1926 to 1947	1.71	1.53
1949	1.71	1.72
1953	1.85	1.94
1955	1.91	—
1939 to 1947	—	1.33
1949	—	1.80
1953	—	2.18
1947 to 1949	1.78	3.73
1953	2.35	3.33
1955	2.45	—
1949 to 1953	2.64	3.14
1955	2.68	—
1950 to 1953	2.63	2.20
1955	2.67	—
1951 to 1953	3.24	2.82
1955	3.01	—
1953 to 1955	2.76	—
1954 to 1955	3.03	—

SOURCE: The Canadian rates are derived from estimates of G.D.P., employment and hours prepared by the Commission and described herein.

The U.S. rates are based on estimates by John W. Kendrick of the National Bureau of Economic Research as revised for the Joint Committee on the Economic Report.

United States is a little wider. Secondly, in both countries, the figures based on comparisons of 1926 with postwar years are lower than those based on comparisons among postwar years.

One would naturally be inclined to discount figures for comparisons that span the Great Depression and World War II. Moreover, the view might be taken that the future will resemble our recent experience more closely than our remote experience. These considerations, plus the fact that the data are the less trustworthy the earlier the period to which they refer, have led us to give more weight to compounded rates of growth over recent intervals than over longer intervals. In the light of these recent rates of growth, both in Canada and United States, fortified by what amounts to a faith in the cumula-

tive growth of knowledge and applied science, and mindful of the kinds of shifts of production to be expected in Canada, we have predicted that the G.D.P. per man-hour in the business sector of the Canadian economy will rise at a compounded average annual rate of between 2.50% and 3.25%. We are obliged to repeat, however, how difficult it is to evaluate the forces that play upon and determine this most important factor in the analysis of our prospects. Perhaps we may sum up our position by declaring that we have a moderate degree of confidence that the range we have predicted will embrace the rate of growth of productivity that will be realized, just as it embraces most of the rates we have computed from the brief record of our past experience. It is our view that any rate within this range is equally likely. While we should be surprised if the rate were to fall outside the range we should not be more surprised if it fell on one side than if it fell on the other.

In Table 5. 12 the forecasts for this sector of the economy are summarized in index number form. It is predicted, on the basis of the assumptions we have set forth, that G.D.P. in the business sector (in 1949 dollars) will be three to three and one-half times its present size, should net immigration into Canada amount to 75,000 per annum.

Table 5. 12

THE FORECASTS OF BUSINESS OUTPUT[a]

(based on the assumption of net immigration of 75,000 per annum)

	1955	1965	1970	1975	1980
Employment	1.00	1.32	1.52	1.73	1.94
Average weekly hours per man	1.00	.91	.89	.86	.83
G.D.P. per man-hour (lower forecast)	1.00	1.28	1.45	1.64	1.85
G.D.P. per man-hour (higher forecast)	1.00	1.38	1.62	1.90	2.22
G.D.P.[b] (lower forecast)	1.00	1.54	1.95	2.42	2.98
G.D.P.[b] (higher forecast)	1.00	1.68	2.18	2.80	3.58

a Index numbers based on 1955.

b For any year the product of the index of employment and the index of average weekly hours per man and the index of GDP per man-hour does not necessarily equal that of GDP because of rounding.

3. *Output in the Government and Community Services Sector*

We have predicted, as reported above, that employment in the army together with employment in civil services, and a variety of community services, will double between 1955 and 1980. We shall, in this section, examine the record of output per man in this sector and explain our forecast of this productivity factor.

The record of output per man in this sector is, of course, a very complicated one, both because of the heterogeneous character of the sector and

because of the extreme difficulty of interpreting the meaning of output in some sub-sectors. It is shown in Table 5. 13. The outstanding feature of the record is that the figures of the late '20's are of the same general order of magnitude as those of the late '40's and the average of the figure for the early '30's is the same as the average of the figures for the early '50's, even though the early '30's were depressed times and the early '50's were booming times. It is true that in the last nine years, the figures have shown an almost unbroken decline; but they also showed a long decline in the early '30's.

Table 5. 13

OUTPUT PER MAN-YEAR IN THE GOVERNMENT AND COMMUNITY SERVICES SECTOR[a]

	Number employed (thousands)	G.D.P. (millions of 1949 dollars)	G.D.P. per man-year (1949 dollars)
1926	251	715.2	2,849
1927	260	754.2	2,901
1928	269	786.3	2,923
1929	274	822.2	3,000
1930	288	861.5	2,991
1931	299	869.5	2,908
1932	304	837.9	2,756
1933	297	783.9	2,639
1934	307	815.7	2,657
1935	309	831.4	2,691
1936	315	845.7	2,685
1937	308	896.3	2,910
1938	325	952.8	2,931
1939	326	1,005.0	3,083
1940	417	1,335.8	3,203
1941	597	1,869.0	3,131
1942	802	2,288.4	2,853
1943	1,053	2,862.9	2,719
1944	1,171	3,057.1	2,611
1945	1,165	2,830.8	2,430
1946	650	1,633.9	2,514
1947	497	1,469.0	2,956
1948	520	1,500.5	2,886
1949	549	1,570.1	2,860
1950	579	1,646.7	2,844
1951	624	1,755.2	2,813
1952	674	1,881.4	2,791
1953	707	1,977.9	2,798
1954	740	2,059.4	2,783
1955	782	2,132.6	2,727

a Including armed services.

Of course one expects to encounter rising productivity figures in the record of Canadian experience. But it must be remembered that the figures now under discussion pertain to output per man and not output per man-hour, so that some of the gains in productivity per man-hour have been off-

set in these figures by the effect of the reduction in hours worked. But this is certainly not the whole story, since for a large component of the output of this sector, namely that of the civil services of governments, output has been measured by payrolls and real output by payrolls deflated by an index of wage rates; real output per man measured in this way necessarily will be almost constant (apart from changes in the composition of the service).

One is inclined to take the view that even though statistical problems have led to the unexpected result of rather constant output per man in this sector over the last 30 years, this is no reason for not reflecting in the forecast figures a feeling that output per man in this sector will grow. We feel, however, that we cannot ignore the statistical eccentricities of the data in the record. The record is what it is and it is all we have with which to compare our expectations of the future. If we were to translate our expectations of the future into ideal statistics free from the weaknesses of statistics produced in practice, we would have to record our expectations on a scale with no zero and no definition of units. If our forecasts of changes are to be meaningful (as constrasted with accurate)—and only a forecast of change can be meaningful—we must express them, as best we are able, so as to permit comparison with the record.

In the light of this argument, we felt we had no choice but to forecast a continuing stability (in the sense of erratic fluctuation within a range) of G.D.P. per man in the government and community services sector. Even then the choice of the figure was difficult to decide upon. We selected $2,820, which is just slightly lower than the value of the average for the nine years ending in 1955.

The forecasts for this sector are summarized in index number form in Table 5. 14. Since G.D.P. per man has been assumed to be constant, G.D.P. like employment will approximately double between 1955 and 1980.

Table 5. 14

THE FORECASTS OF OUTPUT IN THE GOVERNMENT AND COMMUNITY SERVICES SECTOR[ab]

(based on the assumption of net immigration of 75,000 per annum)

	1955	1965	1970	1975	1980
Employment	1.00	1.37	1.56	1.76	1.99
G.D.P. per man	1.00	1.03	1.03	1.03	1.03
G.D.P.[c]	1.00	1.42	1.61	1.82	2.06

a Including armed services.
b Index numbers based on 1955.
c The product of the first two index numbers in a column does not necessarily equal the last because of rounding.

4. *Residential Rents*

Among the productive services rendered in the economy are those of residential property, and the real rents paid or imputed to owners are taken as a measure of this portion of G.D.P. These real rents include depreciation on the associated property but exclude property taxes and mortgage interest.

In forecasting the real value of residential rents advantage was taken of the forecast made in the consumer expenditure study and described there. The figures of rents studied in that project showed the same movement as the real residential rents shown in the G.D.P. breakdown, so that we felt justified in predicting that the movements in the G.D.P. series would be the same as those in the consumer expenditure series. Analysis of predicted movements in that series may be found in the Commission's Study of *Consumption Expenditures in Canada*. The record and the forecasts of residential rents are shown in Table 5. 15.

Table 5. 15

RESIDENTIAL RENTS AS A COMPONENT OF G.D.P.

(millions of 1949 dollars)

1926	345.4	1940	452.3	**1965**	1,100
1927	361.3	1941	412.8		
1928	372.4	1942	475.7	**1970**	1,340
1929	386.0	1943	487.4		
1930	390.9	1944	498.4	**1975**	1,600
1931	394.0	1945	508.3		
1932	392.7	1946	522.4	**1980**	1,910
1933	396.4	1947	537.2		
1934	407.5	1948	570.3		
1935	418.5	1949	614.6		
1936	424.1	1950	652.7		
1937	432.1	1951	690.2		
1938	437.0	1952	714.8		
1939	444.4	1953	749.2		
		1954	787.3		
		1955	823.6		

VI. *Adjustments*

1. *Adjustment for Indirect Taxes*

It was stated in Part IV of this chapter that the G.D.P. at factor cost differs from the G.N.P. in that to obtain the G.N.P. from G.D.P. we must subtract from the latter net payments abroad of earnings of factors of production, and add indirect taxes less subsidies and an inventory valuation adjustment. The inventory valuation adjustment, a technical item, plays no part in the forecasts. In this section and the next we describe our forecasts of indirect taxes less subsidies and of net payments abroad of earnings of factors of production.

The total of indirect taxes less subsidies has, since 1926, apparently been a remarkably constant proportion of G.D.P. in current dollars[8] and hence the forecast has been based on the assumption that the average value of this proportion for the years 1947-55 would continue to hold, and it has been applied to the forecasts of G.D.P. in constant 1949 dollars to produce forecasts of indirect taxes in constant 1949 dollars. In Table 5. 16 the record of G.D.P. in current dollars, indirect taxes less subsidies in current dollars, and the ratio of the latter to the former is given.

Table 5. 16

INDIRECT TAXES LESS SUBSIDIES AS A PERCENTAGE OF G.D.P. AT FACTOR COST

(millions of current dollars)

	Gross Domestic Product at factor cost	Indirect taxes less subsidies	Indirect taxes less subsidies as a % of G.D.P.
1926	4,843	612	12.6
1927	5,177	634	12.2
1928	5,600	679	12.1
1929	5,670	681	12.0
1930	5,184	593	11.4
1931	4,254	557	13.1
1932	3,477	537	15.4
1933	3,241	537	16.6
1934	3,668	577	15.7
1935	3,966	585	14.8
1936	4,277	660	15.4
1937	4,877	704	14.4
1938	4,836	638	13.2
1939	5,223	733	14.0
1940	6,303	830	13.2
1941	7,689	1,054	13.7
1942	9,657	1,085	11.2
1943	10,268	1,117	10.9
1944	11,036	1,111	10.1
1945	11,018	1,003	9.1
1946	10,999	1,269	11.5
1947	12,439	1,604	12.9
1948	14,096	1,772	12.6
1949	14,939	1,830	12.2
1950	16,569	2,018	12.2
1951	19,331	2,478	12.8
1952	20,809	2,714	13.0
1953	21,787	2,901	13.3
1954	21,522	2,914	13.5
1955	23,754	3,177	13.4

2. *Adjustment for Net Payments Abroad of Interest and Dividends*

Conceptually it is necessary to subtract from the G.D.P. net payments to foreigners of factor shares of all kinds in order to obtain G.N.P. at factor

[8]The G.D.P. in current dollars is derived from the G.N.P. by making the usual adjustments in current dollars. That is, indirect taxes are subtracted and net payments of income to foreigners and subsidies added.

cost. However, as experience indicates that this figure has been made up almost entirely of net payments of interest and dividends we have concentrated upon them. In Table 5. 17 the payments and receipts of interest and dividends since 1938 are recorded, together with the net payments figure.

Table 5. 17

INTEREST AND DIVIDEND PAYMENTS ON INTERNATIONAL ACCOUNT

(millions of current dollars)

	Interest and dividends		
	Paid	Received	Net payments
1938	307	66	241
1939	306	57	249
1940	313	52	261
1941	286	60	226
1942	270	67	203
1943	261	59	202
1944	264	71	193
1945	251	80	171
1946	312	70	242
1947	337	62	275
1948	325	70	255
1949	390	83	307
1950	475	91	384
1951	450	115	335
1952	413	145	268
1953	404	165	239
1954	431	143	288
1955	467	160	307

SOURCE: D.B.S. publications on Canadian Balance of International Payments.

If foreign investment in Canada continues to increase during the coming quarter century and if this increase is greater in the early part of the period than in the latter part, then, bearing in mind that some foreign earnings will not be remitted but ploughed back, it seems a not unreasonable guess that gross payments of interest and dividends abroad may amount to some $1,100 million by 1980, a figure rather more than double the 1955 value. While Canada may continue as a net importer of capital, she will nevertheless increase her assets abroad and perhaps at an increasing rate. Her receipts of interest and dividend payments from abroad will therefore grow, perhaps to $300 million by 1980. This figure is just under the value of twice the 1955 figure. It is very difficult to be precise about these matters, but these assumptions lead to the following forecasts:

Net Payments Abroad of Interest and Dividends[9]

1965	$575 million
1970	675 "
1975	750 "
1980	800 "

[9]No attempt has been made to deflate these figures as no generally satisfactory way of deflating such a series is known.

Further discussion of various aspects of the balance of payments is given in several other Commission studies as well as below in Chapter 7.

VII. *The Forecasts of the G.D.P. and G.N.P.*

1. *The Forecasts of the G.D.P.*

A summary of the forecasts of G.D.P. by sector is given in Table 5. 18, which may be compared with Table 5. 6 shown earlier.

Table 5. 18

THE FORECASTS OF OUTPUT, BY SECTOR

(net immigration assumed to be at the rate of 75,000 per annum)

(constant 1949 dollars)

A. AVERAGE ANNUAL RATE OF INCREASE OF PRODUCTIVITY IN THE BUSINESS SECTOR: 2.50%

	Agriculture		Business		Government and community service		Residential rents		Total
	$billion	%	$billion	%	$billion	%	$billion	%	$billion
1955	2.3	12.1	14.1	72.7	2.1	11.0	.8	4.2	19.4
1965	2.3	8.0	21.7	76.6	3.0	10.7	1.3	4.7	28.3
1970	2.5	7.1	27.5	78.5	3.4	9.8	1.6	4.6	35.0
1975	2.7	6.3	34.1	80.3	3.9	9.1	1.8	4.2	42.5
1980	2.9	5.7	42.1	82.1	4.4	8.6	1.8	3.6	51.2

B. AVERAGE ANNUAL RATE OF INCREASE OF PRODUCTIVITY IN THE BUSINESS SECTOR: 3.25%

	Agriculture		Business		Government and community service		Residential rents		Total
	$billion	%	$billion	%	$billion	%	$billion	%	$billion
1965	2.3	7.6	23.3	77.9	3.0	10.1	1.3	4.4	29.9
1970	2.5	6.5	30.7	80.3	3.4	9.0	1.6	4.2	38.2
1975	2.7	5.6	39.5	82.5	3.9	8.1	1.8	3.7	47.8
1980	2.9	4.9	50.5	84.7	4.4	7.4	1.8	3.1	59.6

A fuller presentation of the results given in Table 5. 19 shows differences made by alternative immigration assumptions as well as by alternative assumptions concerning productivity in the business sector of the economy.

2. *The Forecasts of the G.N.P.*

The briefest summary of our forecasts is the following:
Given the assumptions
population in 1980 will be............................... $26.7 million ± 3.5%;
the labour force in 1980 will be.......................... $ 9.9 million ± 3.8%;
the G.N.P. in 1980 in 1949 dollars and on the assumption of net immigration equal to 75,000 per annum will be.................... $61.75 billion ± 7.7%;
the G.N.P. in 1980 allowing for all variations

in assumption concerning productivity
and net immigration will be............................ $62.0 billion $\pm$ 11.5%.

A more detailed presentation of the results is given in Table 5. 20.

Table 5. 19

THE FORECASTS OF OUTPUT, BY SECTOR

(alternative net immigration assumptions)

(billions of constant 1949 dollars)

		Net immigration per annum		
		50,000	75,000	100,000
1955	Agriculture................	2.3	2.3	2.3
	Business..................	14.1	14.1	14.1
	Government and community service.......	2.1	2.1	2.1
	Total G.D.P.[a]...............	19.4	19.4	19.4
1965	Agriculture...............	2.2	2.3	2.3
	Business (2.50 basis) [b]	21.3	21.7	22.1
	(3.25 basis).......	22.9	23.3	23.8
	Government and community service.......	3.0	3.0	3.1
	Total G.D.P. [a] (2.50 basis).....	27.8	28.3	28.8
	(3.25 basis).....	29.4	29.9	30.5
1970	Agriculture...............	2.4	2.5	2.6
	Business (2.50 basis)	26.8	27.5	28.3
	(3.25 basis).......	29.9	30.7	31.5
	Government and community service.......	3.4	3.4	3.5
	Total G.D.P. [a] (2.50 basis).....	34.1	35.0	36.0
	(3.25 basis).....	37.2	38.2	39.2
1975	Agriculture...............	2.6	2.7	2.8
	Business (2.50 basis)	33.0	34.1	35.2
	(3.25 basis).......	38.2	39.5	40.8
	Government and community service.......	3.8	3.9	4.0
	Total G.D.P. [a] (2.50 basis).....	41.1	42.5	43.9
	(3.25 basis).....	46.3	47.8	49.4
1980	Agriculture...............	2.8	2.9	3.0
	Business (2.50 basis)	40.4	42.1	43.7
	(3.25 basis).......	48.5	50.5	52.4
	Government and community service.......	4.3	4.4	4.5
	Total G.D.P. [a] (2.50 basis).....	49.3	51.2	53.1
	(3.25 basis).....	57.3	59.6	61.9

a Including residential rents.

b The "2.50 basis" and the "3.25 basis" refer to the alternative assumptions concerning the average annual compound rate of increase of productivity (G.D.P. per man-hour) in the business sector of the economy.

A final word may be entered here concerning alternative assumptions. One is tempted to try to convey the impression of uncertainty by presenting alternatives for all assumptions. It will readily be realized, however, that such a practice would yield, because of the number of combinations of assump-

tions possible, an absolutely unmanageable number of forecasts. The fact that for most of our assumptions we have not made alternatives is no indication of our confidence but is rather a concession to necessity. We have limited ourselves to variations in the two assumptions—productivity in the business sector and net immigration per annum—which, because of the magnitudes involved, really make significant differences in the total of G.N.P. that is predicted. The forecasts of the output of sectors is consequently weaker and more difficult to interpret than the forecast of G.D.P. or G.N.P. as a whole. Other studies concentrate on the sectors, however.

Table 5. 20

SUMMARY OF FORECASTS: POPULATION, LABOUR FORCE AND GROSS NATIONAL PRODUCT

		The Forecasts			The Forecasts as percentages of 1955 Figures		
		Net immigration per annum			Net immigration per annum		
		50,000	75,000	100,000	50,000	75,000	100,000
1955	Population (millions)	15.6	15.6	15.6	100	100	100
	Labour force (millions)	5.6	5.6	5.6	100	100	100
	G.N.P. (billions of constant 1949 dollars)	21.6	21.6	21.6	100	100	100
1965	Population	19.2	19.5	19.8	123.4	125.3	127.3
	Labour force	6.9	7.0	7.1	123.3	125.6	128.0
	G.N.P. (2.50 basis)[a]	30.8	31.4	32.0	142.9	145.7	148.5
	G.N.P. (3.25 basis)[a]	32.6	33.3	33.9	151.3	154.1	157.3
1970	Population	21.2	21.6	22.1	135.9	139.0	142.1
	Labour force	7.7	7.9	8.1	138.6	142.4	146.1
	G.N.P. (2.50 basis)	37.9	38.9	40.0	175.6	180.6	185.5
	G.N.P. (3.25 basis)	41.3	42.5	43.7	191.4	197.2	202.6
1975	Population	23.3	24.0	24.7	149.7	154.1	158.4
	Labour force	8.6	8.9	9.2	154.9	160.1	165.3
	G.N.P. (2.50 basis)	45.7	47.2	48.8	211.8	219.2	226.5
	G.N.P. (3.25 basis)	51.5	53.3	55.1	239.0	247.2	255.5
1980	Population	25.8	26.7	27.5	165.5	171.2	176.8
	Labour force	9.6	9.9	10.3	172.0	178.7	185.4
	G.N.P. (2.50 basis)	54.9	57.0	59.2	254.5	264.6	274.8
	G.N.P. (3.25 basis)	64.0	66.5	69.1	296.9	308.7	320.5

a The "2.50 basis" and the "3.25 basis" refer to the alternative assumptions concerning the average annual compound rate of increase of productivity (G.D.P. per man-hour) in the business sector of the economy.

In Appendix A we present a copy of the single summary sheet to which our calculations of the G.N.P. forecasts were reduced, as the detail contained on it may be of interest to some readers. It should be remembered of course that it is a worksheet and therefore numbers are unrounded, though for 1955, unrounded data were used in the calculations that are reported here in more rounded form.

6

THE ACCUMULATION OF CAPITAL

I. Introduction

In this chapter we discuss the record, insofar as it exists, of fixed capital in the Canadian economy, and our method of forecasting industrial expenditures on new investment and replacement. Our task here, unlike that in the two previous chapters, requires more elaboration and detail, for the subject of fixed capital, especially the *stock* of fixed capital, has not been as fully dealt with in official statistics as have population, labour force, and national product.

It is curious that this is so, because the same early censuses that provide our oldest records of population, occupation and (sometimes) earnings and output occasionally provide a record of the answers to questions about wealth and property. Just as the population data have been subsequently strengthened and elaborated, the wealth data, one would have supposed, would have been polished and classified until by today we had good measurements of the national capital. In fact this has not happened. The ambiguity of the answers given by respondents to census questions about wealth and property made statisticians more and more uncertain about the reliability of such data. Economic theory raised further doubts. The widespread acceptance of the "Austrian" view of capital led many specialists to the opinion that it was *conceptually,* let alone statistically, impossible to measure the quantity of assets in any common value unit. Furthermore, the end of the vogue for this type of theory was due to a new "macro-economic" interest in national income, output and consumption, which led to the diversion of statistical effort to the measurement of these variables through national accounting.

One by-product of the current importance of measuring these Keynesian aggregates, however, has been a determined attempt to predict and to measure capital formation. This investment information provides the raw material for studies of capital. As the record lengthens (most series were commenced soon after 1945) the pattern gradually unfolds, and useful

analysis becomes possible. The present chapter is an attempt at such aggregative analysis.[1]

The ultimate aim of nearly all the literature cited has been to enable the analyst to predict the quantity and type of investment in the short run. William Fellner is the chief exception to this generalization, and even he, in applying his method, turns to a very short period of years. We should also mention that there are many specialized studies of investment needs in particular sectors or regions, for long periods in the future. Both these exceptions have in common that they find it impossible to confine their attention to the past relationship of investment expenditure to output—they have been forced to turn to the stock of capital (or to changes in the stock) as an operative dependent variable. This is true also of this chapter. We believe that it is not enough, looking ahead 25 years, to concentrate on investment, which is at best a volatile, unpredictable and unstable variable. Rather we intend to attempt first to measure the stock of fixed capital, then to attempt to determine the "required" amount of capital, and finally to calculate the annual capital formation necessary to maintain that stock.

The chapter would be more valuable if we had been able to undertake this process sector by sector, industry by industry or region by region. Time has not permitted this procedure, and we have been forced to produce an aggregative forecast. The estimation of the national capital has, however, necessitated estimation by industry, and these industrial stock estimates are explained and published here. Consequently, a good part of the space in the chapter is devoted to the presentation of source, method and result of these industrial stock calculations; the remainder is devoted to a brief analysis of the record and to an exposition of our industrial capital formation forecasts.

II. *Purpose of the Chapter*

This chapter has two purposes which are interrelated. The first is comparable with that of other special chapters in this study: the prediction of

[1]We should not, however, give the impression that investment data have never been analyzed. Dr. O. J. Firestone, who is responsible for much of the new Canadian data, presents an exhaustive examination of the period since 1926, particularly with respect to the effect of the business cycle on investment, in the early pages of *Private and Public Investment in Canada, 1926-1951*, published in 1951 by the Department of Trade and Commerce. This publication has been kept up to date by the *Outlook*, which presents not only the data for recent years but also the record of investment intentions during the forthcoming year; Dr. Firestone has published an analysis of this data, particularly of the reliability of the forecasts, in *Short-Term Economic Forecasting*, published in 1955 by the National Bureau of Economic Research. An earlier investigation covering some of the same period is *Public Investment and Capital Formation*, prepared for the Dominion-Provincial Conference on Reconstruction in 1945 by Dr. Firestone and Mr. M. C. Urquhart; but this work concentrates on the production of new data. Finally we may refer to Kenneth Buckley's recently published *Capital Formation in Canada, 1896-1930*, which presents both data on and analysis of investment in the context of Canadian growth. Economists have recently exploited very actively the American data available. We may mention particularly various works by C. F. Roos, commencing with *Dynamic Economics*, Bloomington, 1934; Jan Tinbergen, *Statistical Testing of Business-Cycle Theories*, Geneva, 1939 and subsequent publications; L. R. Klein, in his general econometric studies and particularly in "Studies in Investment Behavior" in *Conference on Business Cycles*, New York, 1951; R. W. Goldsmith, in a *Study of Saving*, Vol. 3, Princeton, 1956; George Terborgh, in many publications for the Machinery and Allied Products Institute, especially in the periodical *Capital Goods Review;* William Fellner, in "Long-Term Tendencies in Private Capital Formation" in *Long-Range Economic Projection*, New York, 1954; and Simon Kuznets and others associated with the National Bureau of Economic Research, who, however, have in this field until very recently concentrated more upon the very difficult job of obtaining data than upon elaborate analyses of their findings. We should also mention the authoritative but brief analyses printed periodically in the official *Survey of Current Business* by Messrs. Nassimbene, Wasson and Wooden.

the size of one of the main flows in the Canadian economy—the expenditure on gross domestic investment for new non-residential construction and new machinery and equipment.

The second purpose of this chapter is to examine the role that such investment expenditures have played in the past. Investment is one use of such Canadian resources as labour and capital already in existence, in competition with other uses of these resources, such as the production of consumption goods or of things for social use or for export. From this point of view, the amount of investment is an important factor in the employment situation in Canada, especially as the amount of investment is so indicative of the vigour of the economy. The historical record, however, is also useful if properly interpreted, because it contains information which in a sense implies how much investment is *necessary* to obtain output of a certain quantity in Canada using certain techniques of production, certain goods and materials from other countries, in the particular circumstances of climate, resource availability, markets and transportation.

It must be emphasized that these two aspects of the historical record are not separate, and that in any view of Canada's economic future, they must be regarded as a single process which has been carried on in the past and will continue indefinitely into the future. For the industrial community has in every year diverted from other uses by the Canadian people about one-tenth of the output of the economy and transformed it into a *stock* of capital goods which has been useful and necessary for the production of the Gross National Product of ensuing periods.

If we attempt to classify the motives for this diversion of resources, we must recognize, of course, that there has not been a far-seeing mental wizard at the control board of the Canadian economy, but that market forces and technical difficulties have induced a multitude of businessmen to make a variety of decisions of varying wisdom. Each such business decision has been intended to advance the economic position of the businessman or of his business, and each businessman's impression of the best way of achieving this end has been particular to him and to his own situation.

Some of these decisions have been erroneous from every point of view. Other investments have been made in situations where the competition among members of an industry dictated an investment in capacity which was more than the total output of the industry warranted. Others again have been of an enterprising or indeed adventurous nature, indicating a willingness to risk large losses on the chance of large profits, even though all such risks cannot pay off. Finally a great deal of investment has been undertaken as the outcome of careful or fortunate appraisals of future needs; such investment is, therefore, from almost every point of view, the "necessary" amount in the given circumstances.

We can be sure, however, that future Canadian industry will be dominated as much as it is now by businessmen who make erroneous and highly adventurous investment decisions, and by a situation which makes it seem necessary for rivals to "overinvest" in order to maintain their position. Further, the rapid growth of the population and of the labour force suggests that businessmen will, in the future, have to make decisions involving larger amounts than in the past, and they will have to make them more rapidly. Therefore, a classification of investment decisions into those which are good or bad, or into those which are justified or unjustified, is not particularly helpful. Our general point of view must be that businessmen make investment decisions because they wish to make profits (or capital gains) by having the right amount of plant and equipment available for the amount of production which is most advantageous to them in future periods.

All investment decisions can, however, helpfully be classified in the following way. Capital goods may be purchased (1) to replace those that have become inefficient through wear-and-tear, (2) to replace existing equipment which has become so outmoded that the business man's competitors can turn out better and/or cheaper goods and services, and (3) to supply a market for final goods and services which is growing because of population increase or changes in tastes or needs.

At various periods in the past, one or another of these three types of investment decisions has been predominant. In the depression, for example, the replacement of worn-out machinery was for most enterprises the only excuse for spending money on capital goods. But during the earlier conversion of the shipping industry from wood to steel, the shipowners found that obsolescence of their wooden ships was the chief reason for spending heavily on re-equipping their fleets. Finally, in recent years, in Canada, it is probable that a great deal of investment expenditure has been a simple manifestation of industry needing more tools to equip more men to sell more goods to more people. This final process is usually referred to as broadening or widening the capital structure of the economy.

In the next 25 years, Canada will undoubtedly witness a large amount of investment for all of these three reasons. How much will there be? In viewing the historical and statistical record which is now available to him, the economic analyst may learn only how much investment annually took place. He has no way of gauging how much of it was necessary for replacement and how much for broadening the capital structure. This restricts the use that can be made of the record in contemplating the future capital requirements of Canadian industry. In making this forecast, therefore, it is proposed that we review the record, with the purpose of discovering, by techniques not so far used in Canada, how much investment was merely replacement of old capital goods, and how much represented growth.

III. *Method*

In this section we wish merely to indicate in broad strokes the method that has been used in the study of industrial capital. Appendix C to this chapter contains a fuller record of sources and methods employed.

We have observed that past investment has consisted of a mixture of expenditure for replacement and for expansion which is very difficult to disentangle.

Let us attempt here to suggest how this mixture may be analyzed. New investment expenditure is a flow which may be likened to a stream entering a reservoir. The reservoir does not rise indefinitely, because a balancing flow is escaping from it which may be likened to the discarding of obsolete goods or their wastage from wear-and-tear. Investment expenditure, of which we have a record for the past 30 years in Canada, is analogous to the inflowing stream, yet we have very little knowledge of the statistical stock: Has the reservoir been rising or has the increasing inflow been balanced by a similar increasing wastage and scrapping of investment goods? We cannot predict the future of the inflowing of investment goods from the past history of this inflow, unless we are content to assume that the inflow satisfied a need in itself; that is, unless we are content to imagine that businessmen were interested only in the investment process; not in the size of the stock of machines (the reservoir) which that inflow fed and replenished.

Now we know perfectly well that businessmen are not interested in the inflow of capital goods (apart from those whose business it is to provide them or to finance them). Rather, they are interested in having on hand the correct number of machines of the right type to replace wastage and obsolescence, and to build up the stock as required. Therefore, in order to understand better the inflow of past years, we must attempt to record the level of the reservoir; that is, we must attempt to measure the growth of the capital stock of industry. If we can do this, we will know how much of the inflow of particular years has been absorbed in replacing discarded goods, and how much has been used to build up the stock of fixed capital.

In general, this quest for measurements of the stock of capital has resulted in the use of one of three clearly distinguishable techniques:

1. *Adding Balance Sheet Asset Figures*

Most corporations and many other businesses carry in their accounts valuations of their fixed assets. These balance sheet asset figures may be aggregated firm by firm, and industry by industry, to provide a total for the whole economy for a particular year. This is approximately the method used to obtain the so-called census of capital, capital employed, or of wealth, published in the United States and Canada at various times in the past. In Canada, for example, the census of industry collected from manufacturing

enterprises data on capital employed annually from 1920 to 1943. In the United States the census of manufactures showed by various classifications the book value of fixed and working capital. In most countries, income and property tax data give information about the total value of various types of taxable wealth, or the sources of various types of taxable income; and other sources, such as the *Statistical Summary of the Bank of Canada* and *Taxation Statistics,* published collections of balance sheet information useful for the study of corporate financing.

It is generally believed that such information is not reliable, or that if it is reliable, it is very hard to interpret. Corporations responding to questionnaires use different methods of valuing their capital: they may, for example, use original cost, market price or replacement cost; they may show figures net or gross of depreciation; they may include or exclude land; they may unexpectedly write up or down the value of fixed assets to include the goodwill of the enterprise on the occasion of a financial reorganization.

There are good reasons for any one of them following any of these procedures, and if all followed the same procedure (or even if it were known how many followed each procedure), some use could be made of the aggregate information. The difficulty is that the number of firms following each procedure is unknown, and further, that as corporations change ownership, financial structure, or tax situation, they may change the convention which they follow in reporting the aggregate of the value of their assets.

It must be mentioned, however, that in the absence of other estimates, such census aggregates of balance sheet figures have been fairly widely used by economic analysts with results that have been incapable of independent verification, but apparently acceptable to their users. The best results have, of course, accrued to those who were comparing such capital estimates with other figures from the same general source. (For example, those who have compared foreign ownership with total ownership of various kinds of industry.) Furthermore, in the case of the United States census of manufactures, Daniel Creamer in the National Bureau of Economic Research Occasional Paper No. 41, has undertaken to show that at least in 1919 the census capital figures were "reasonable" when compared with other series of information on the same industries. Most students, however, have less faith than this in the "capital employed" figures that were collected in the Canadian census of industry, and it is probably for this reason that their collection was discontinued in 1943.

For our own purposes, since the census of industry covers only manufacturing, mining and electric power industries which, on most scales of measurement, occupy less than half of the total for the Canadian economy, some other method of measuring the stock of capital is in any case required.

It may be well to mention here that the work done by Mr. R. N. Grosse, a colleague of Professor W. W. Leontief, published in the volume *Studies*

in the Structure of the American Economy (New York, 1953), since a great deal of data used comes from balance sheet sources, combined with engineering information and investment expenditure data. A wide variety of sources was used to obtain the capital coefficients needed. The basic concept, for which approximations were estimated, was that of *incremental* capital coefficients, i.e. the stock of capital of all kinds required per unit of capacity[2] increase in each industry. These were computed by Grosse from data on newly constructed plants or from direct engineering information. When neither of these types of information was available, average coefficients were calculated from estimates of total stock and capacity.

Leontief and his associates made this calculation for 1939. Such an elaborate and painstaking procedure depends on a richness of data which is not now available in Canada, and one expertise in interpreting the stock or coefficient estimates from a variety of sources for each industry.

2. *The Capitalization Method*

Next we may review a method that has been used by individual scholars from time to time, especially in the United Kingdom. A recent application of this method is to be found in "The Climacteric of the 1890's: A Study in the Expanding Economy", by E. H. Phelps Brown, with S. J. Handfield-Jones, published in the *Oxford Economic Papers* of October, 1952. The authors showed that an annual series of capital figures calculated by the capitalization method, started from a "firm" capital stock estimate for a base year, gave results which were not greatly different from those derived by the method described below as the cumulation method.

The basic procedure depends upon first estimating the incomes (such as profits, rents and interest) arising from various kinds of asset. These incomes must then be capitalized at various conventional ratios of capital value to income, which are usually called the relevant number of "years' purchase". It is customary in Great Britain to quote the price of a profitable asset in terms of the number of years which would be required for the current profits to add up to the price of the asset. Thus, a house which returns to its landowner 5% of its cost each year may be said to have a value equal to 20 years' purchase. In a sense, therefore, the term "years' purchase" is merely an inversion of the going percentage rate of return on various kinds of capital asset. For example, the authors capitalize the British income tax estimate of the annual rental of houses at 14.56 years' purchase, whereas profits from industrial enterprise were capitalized at 6.92 years' purchase. (Part of the difference between these two figures presumably reflects the greater profitability of investment in industry over that in houses. However, another part of it may reflect the fact that different rates of tax, different amounts of risk,

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[2]See the discussion of the problems of this concept in R. T. Bowman and Almarin Phillips, "The Capacity Concept and Induced Investment", *Canadian Journal of Economics and Political Science*, Vol. XXI, May, 1955, pp. 190-203.

or different amounts of depreciation, apply to the two kinds of property.) As remarked above, this method gave Messrs. Phelps Brown and Handfield-Jones a quite remarkable correspondence to capital estimates calculated by the cumulation method. Over a 40-year period the divergence between the two methods of estimating total capital was less than 3.5% of one of them.

This method, however, requires a very nice classification of the various types and sources of income, such as is perhaps available only under the British schedular income tax system. Canadian income returns are not on the whole classified by the kind of property which gives rise to the income; in addition, many incomes from unincorporated enterprises and farms are an unassorted mixture of wages, rents, profits and interest. An even greater difficulty with this procedure from our point of view, however, is that it seems to assume in the method a variant of the answer which is ultimately required. In effect, in order to get a capital-output ratio for the British economy, Phelps Brown's years' purchase system assumes capital-output ratios. There is no doubt that the Phelps Brown capitalization methods' close correspondence with the results of his cumulation method would not have been so close had not his base figure, which was for 1912, been worked up by the cumulation method itself.

For purposes of prediction or forecasting, therefore, it is unwise to use this capitalization method as a means of studying the change over time of the capital-output ratio, because in begging the question of the ratio, it reduces to a method of showing changes in the distribution of income as among rents, profits, interest and wages in the past, and a prediction of how this distribution may continue to change in the future.

3. *The Cumulation Method*

The cumulation method, the third of our three alternatives, is the method that has actually been used in the present study.

The necessary information consists of

(i) annual investment expenditure figures and

(ii) estimates of the service lives of the assets that are used by the various industries.

To illustrate the method, assume that the service life for all fixed capital goods is 30 years. Then if we begin with the expenditure of year 1, in the next year we add to it the investment expenditure of year 2, and in each subsequent year add the investment expenditures of that year. When we have done this for 30 years, the assumed service life of the investment expenditure of year 1 will have completely elapsed, so that in the 31st year we must deduct from the cumulated total of the investment expenditures of 31 years the investment expenditure of the first year. In the 32nd (and all subsequent

years) we proceed in the same manner; that is, as we come to each new year we add to the cumulated total the investment expenditure of the new year and subtract from it the "discarded" investment expenditure made 30 years earlier. The cumulated total to any year before the 30th is not a usable figure, but at the end of 30 years the cumulated total is a measure of the capital stock in place since, by assumption, all investments made earlier than 30 years previously have been discarded. From the 30th year onward, we have what Raymond Goldsmith, who is a leading practitioner of this method, has called a "perpetual inventory" of capital. To reiterate the description in its simplest terms, the method amounts merely to taking a capital stock figure, adding to it new investments as they take place, and subtracting from it the value of those capital goods purchased earlier which are assumed now to be in the process of discard.

It will be seen that if we had for the first year a "firm" estimate of the capital stock, we could add to it the investments of all subsequent years *without* waiting for 30 years to pass before having a usable capital stock estimate. The only disadvantage would be that there would be no knowledge for the first 30 years of how much of the stock is due to be discarded each year, so that for the first 30 years some arbitrary assumption would have to be made. This modified procedure and its improvement need not detain us here, however, since we have not for any year for Canada a firm estimate on which to build: out of statistical poverty is born the necessity of cumulating our capital stock figures from zero, and doing without estimates for a period equal to the appropriate service lifetime of assets for a usable capital stock estimate to emerge.

The following expressions summarize in algebraic terms the procedure discussed above:

Let I_n^j = investment expenditure in year n by industry j;

L = service life of asset;

J = number of industries;

G_K^j = gross stock in j^{th} industry in year K;

G_K = gross stock in year K;

N_K^j = net stock in j^{th} industry in year K;

$j = 1, \ldots, J$.

Then G for industry j in year L is $G^j_L = \sum_{n=1}^{n=L} I^j_n$ (1)

The next year it becomes $G^j_{L+1} = I^j_{L+1} - I^j_1 + \sum_{n=1}^{n=L} I^j_n = \sum_{n=2}^{n=L+1} I^j_n$

The year L is the first one for which G covers all existing goods. (2)
For all industries the gross stock required in year L is

$$G_L = \sum_{j=1}^{j=J} G^j_L = \sum_{j=1}^{j=J}\sum_{n=1}^{n=L} I^j_n \quad (3)$$

The net (or depreciated) stock N is the value of fixed assets less accumulated depreciation. It is comparable to the "net assets" figure of a corporation balance sheet. Starting again at zero investment in year zero and cumulating from year 1, we calculate depreciation at 1/Lth of the stock; that is, we apply straight-line depreciation for L years.

By convention, we subtract depreciation of one year from gross investment of the *next* year. If we did not adopt this convention, assets with a one-year life would show each year zero net investment. Further, we would in effect be writing off assets in the year in which they are used, rather than writing them off in the year they are assumed to be completely worn out or out of use. The convention actually adopted has the effect of overstating net investment, and hence, overstating the net stock by one-half the amount invested in the average year of the preceding L years.

If we write the value of the gross stock as $G^j_K \doteq \sum_{n=1}^{n=K} I^j_n$ where $K < L$ (4)

Then depreciation in the next year is $\frac{1}{L} G^j_k = \frac{1}{L} \sum_{n=1}^{n=K} I^j_n$ (5)

Net investment (Δ N) for year n is $I^j_n - \frac{1}{L} G^j_{n-1}$ (6)

When K = L, the net stock will be the cumulation from 1 to L of the net investments of the preceding L years $N^j_K = \sum_{n=1}^{n=K}\left(I^j_n - \frac{1}{L} G^j_{n-1}\right)$ where $G^j_o = O$ (7)

For each year after K = L, the expression in brackets in (7) applies. There is no need to drop discards from the investments of L years earlier that operation is already implicit in calculating the gross stock G^j_K The calculation merely involves a continuous cumulation of net investment $(I^j_{K+1} - \frac{1}{L} G^j_K)$.

Table 6. 1

Table 6. 1 shows the actual computing process. The data are given in column 1; it is assumed that service life for this industry is nine years (L=9).

	1	2	3	4	5	6	7
Operation:	Data	Move 1 on 9 years	1—2	Cumulate 3	Divide 4 by 9	1—5	Cumulate 6
Year	Investment	Discards		Gross Stock	Depreciation	Net Investment	Net Stock
n	I_n	I_{n-L}	$\triangle G$	G_n	$\frac{1}{L}G_{n-1}$	$I_n \frac{1}{L} G_{n-1}$	N_n
1920	3.5	—	—	3.5	—	3.5	3.5
1921	3.3	—	—	6.8	.4	2.9	6.4
1922	4.1	—	—	10.9	.8	3.3	9.8
1923	4.5	—	—	15.4	1.2	3.3	13.0
1924	5.2	—	—	20.6	1.7	3.5	16.5
1925	5.2	—	—	25.8	2.3	2.9	19.4
1926	5.3	—	—	31.1	2.9	2.4	21.9
1927	5.5	—	—	36.6	3.5	2.0	23.9
1928	5.9	—	—	42.5	4.1	1.8	25.8
1929	5.8	3.5	2.3	44.8	4.7	1.1	26.8
1930	5.4	3.5	2.1	46.9	5.0	.4	27.3
1931	3.6	4.1	—0.5	46.4	5.2	—1.6	25.6

The procedure outlined in the text above would provide a good estimate only on certain stringent assumptions, as follows:

(a) that all assets purchased by a certain industry have the same (unchanging) service life, and

(b) that investment expenditure is a measure of the amount of capital goods installed in a certain year.

It is proposed to discuss these two points below. Further detail on the methods of handling these points is to be found in Appendix B to this chapter.

(a) *Service life*

In the outline of the method given above, it was assumed that all investment expenditures represented the purchase of investment goods with a given service life. This assumption is, of course, in need of drastic modification. In the first place, investment expenditures are, roughly speaking, of two types: structures and plant on the one hand, and machinery and equipment on the other. We are fortunate in that the official statistics of investment expenditure, which were gathered in the past by the Economic Section of the Department of Trade and Commerce and are kept up to date by D.B.S., are separated into two categories: construction, and machinery and equipment. In all our work we have maintained this distinction.

Structures are as a rule much more durable than machinery and equipment. If we include dwellings with structures it is not unlikely that the *average* service life of structures is more than 50 years. Machinery and equipment, on the other hand (a term which covers a variety of assets, from heavy paper-making machinery on the one hand, to cash registers and telephone booths on the other) probably has an average life of from 12 to 18 years.

American students using the cumulation method have as a rule assumed a life of 50 years for structures and about 16 years for machinery. One of them however, Dr. George Terborgh, has used a more refined procedure in which he assumes that machines (like human beings) do not last for a predetermined number of years but are governed by distributions of life expectancy which, for any category of asset, express what proportion of the assets of a certain age may be expected to be discarded by industry in each subsequent year. From the point of view of realism, this procedure is greatly to be preferred over one which assumes that all assets of a certain type installed in a given year are discarded in one subsequent year. However, this procedure must be based upon very exact data for each kind of asset; these are, at the present time, not available in Canada. In our own calculations, we have maintained the convenient fiction that the lifetime of an asset can be stated as a given number of years.

The Canadian statistics published by the Economic Section of D.B.S. (and even many of those published for the period 1896-1930 by Kenneth Buckley) show investment expenditure classified according to the industry undertaking the expenditure. This provides a wealth of information not available in other countries, since a more or less consistent definition of investment expenditure has been used by one group of statisticians to cover the whole economy over a long span of years. Not only, therefore, have we maintained in the Canadian cumulation estimates the distinction mentioned above between construction expenditures and machinery and equipment expenditures, but we have also, maintaining the distinction between the various industries undertaking the investment expenditure, cumulated capital stock for each industry separately. From many points of view this is a great advantage, for the final results, imperfect as they may be, show the distribution of capital among industries and sectors of the Canadian economy. Only Leontief, using for 1939 his laborious piecemeal approach, has achieved the same industrial detail.

However, the richness of detail of this industrial classification of investment information has its cost as well as its advantages. The reader will note from the description given earlier of the cumulation procedure that it is necessary to assume a service life for each category of investment expenditure and to hold to that assumption more or less rigorously over time. (It is possible, however, slowly to modify the assumed service life.) When invest-

ment information is classified according to industries instead of assets purchased, the statistician is forced to assume that one service life covers the wide variety of assets purchased by that industry. For example, we may know that motor trucks have on the average a service life of nine years, but motor trucks owned by the wholesale grocery business are, after all, only one part of the wide spectrum of types of capital assets purchased by the wholesaling industry. In the category of machinery and equipment, the wholesaling industry may also purchase scales, trucks, business machinery, furniture, refrigeration equipment, air conditioners, packing and wrapping devices, and even light manufacturing machinery. In assuming one service life for all the machinery purchased by the wholesaling industry, we are in fact making the following two assumptions: first, that we can average the service lives of all of these kinds of assets into one representative figure; second, that the annual expenditures by this industry contain unchanging proportions of each of the main kinds of assets. These are indeed extreme assumptions, and it is necessary that the reader recognize that they have been made and are implicit in all that follows.

Even when the assumptions mentioned above are satisfied by the investment expenditures under examination (or when the data contain offsetting changes which in aggregate amount to a satisfaction of the assumptions), we must recognize that the service life of assets is probably changing over time, and may be changing in different ways for different assets, or indeed, in different ways for the same assets used by different industries. In the present study the service lives used for each industry have been obtained from a variety of sources, but the chief source has been studies made in the 1930's by engineers and accountants to determine amounts of depreciation for purposes connected with claiming of income-tax allowances. These studies have been incorporated into tables of permissible income tax depreciation rates of the United States, Canada and the United Kingdom. The American table of rates (Bulletin F) is by far the most valuable of three, since not only is it presented in great detail, but also, by intention, it is independent of the special income tax allowances made to favoured industries.[3]

However valid these service-life figures may be in their own context, it should be recognized that they apply to the business practices and technology of the 1930's. With few exceptions we have used these figures to cover investment expenditures beginning in the late 19th century and continuing until 1955. While it is a happy situation that the 1930's are on the whole in the middle of this period, and thus the lifetimes derived then may be assumed to be of a central value if there is any sort of long-run trend, nevertheless it is very likely that there has been a trend toward the shortening of the average life of capital goods.

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[3]See Appendix C to this chapter for a further discussion of Bulletin F; see also the discussion in E. L. Grant and P. T. Norton, *Depreciation*, New York, 1949, p. 142.

This shortening applies particularly to machinery and equipment. During the past 30 years construction expenditures in Canada have been much larger than those for machinery and equipment, so that our *total* stock estimates are less likely to be in error because of failure to take into account changing service life than are our stock estimates for machinery and equipment alone. Whatever shortening of the service life of machinery and equipment has taken place is probably a combination of heavier use than was originally intended (that is, the "user cost" has been well in excess of the time rate of depreciation), and also of the increasing rate of technological progress which has correspondingly increased the rate of obsolescence of machinery.

Our information on this subject is very incomplete but we have some reports from specialized industries. Of the electronics industry, for example it is said that for standard machinery and equipment, such as presses, conveyors, belts and metal machinery, a service life of perhaps 15 years is a good average; this is not changing much over time. However, specialized machinery and equipment is experiencing a steadily shortening average life. Highly specialized equipment indeed may be written off in three years, and test equipment may be in use only as long as a particular final product to which it is specially adapted is in vogue.

In the steel industry, we note that the effective life of assets is shortening rather than lengthening, because of technological progress. Open-hearth installations were of essentially the same nature over the whole period 1900-40, but since 1940 the rated output capacity of open-hearth installations and of blast furnaces has climbed enormously. Such acceleration of the output of steel installations may mean that their service life is reduced by the added wear and tear.

This user cost which reduces the life of assets installed, can, of course, operate in the opposite direction. In the textile industry, for example, where the rate of output has increased much more slowly than in the economy as a whole, it is believed that the average age of equipment is increasing.

(b) *Deflation*

The annual expenditures that are cumulated in our procedure register the cost in each year's funds of purchasing a certain quantity of assets. For most purposes we are not interested in dollar amounts of this type, apart from their virtue of providing a common denominator for the addition of assets of many types. In short, we wish our dollar figure to perform the work of a volume index of asset acquisition.

Since the price level changes from year to year and, generally speaking, has over the past 50 years exhibited a pronounced rising tendency, it is necessary that our annual dollar figures, if they are to perform this common denominator task, be stated in terms of the purchasing power of a particular

year. Since the deflated Gross National Expenditure and the Gross Domestic Product are measured at the prices of 1949, for purposes of comparison we should deflate the expenditures of years other than 1949.

This necessitates the use of price indexes for the various kinds of investment expenditures. Ideally, we would employ one price index for each kind of asset, so that year after year our dollar expenditure series on that asset, divided by this price index, would show the relative amounts of that asset bought in each year. Statistical hurdles appear here. In the first place, such price indexes as we have are related to particular kinds of assets, such as passenger automobiles or farm machinery, whereas, with few exceptions our expenditure series which the indexes are to deflate are classified not by assets, but by industries. We ought to work with price indexes weighted according to the asset composition of each industry. In fact we have been forced to decide what is the predominant kind of asset purchased by each industry, and to deflate that industry's expenditures by the index appropriate to that predominant asset. We have said that each industry buys a wide variety of assets, so that we are here making the implicit assumption either that the predominant asset type so predominates as to swamp the expenditures on other types, or that the prices of other assets purchased by that industry move in the same way as the index for the predominant asset type.

Price indexes for capital goods are relatively scarce, especially for the period of the historical record, so that it is very difficult to know whether either of these assumptions is, over a long period, justified. We know that, from year to year, wholesale prices of the various materials used in manufacturing machinery and equipment rise and fall in disparate fashion; their indexes are not harmoniously moving in the same direction at the same time. We know also that the wages paid in various capital goods industries did not advance uniformly. Therefore, we can be fairly sure that in the short period our assumption is not justified.

But over the long period, the few price studies that are available tell us again and again that discordant movements of the prices of various goods and services are overpowered by the over-all uniformity of the so-called general price level. Since the late 1920's, the price level of investment goods has approximately doubled. A representative bundle of capital goods costing a hundred dollars then would cost two hundred today. Particular goods may actually have increased in cost three or even four times, while others have over time become cheaper; nevertheless, if we confine our attention to sufficiently large aggregates we may reasonably claim that our deflated expenditure series is in an appropriate way adjusted for changes in the purchasing power of the Canadian dollar.

The diverse movement of the prices of various kinds of capital goods is illustrated in Table 6. 2. Some of these price indicators apply to machinery

Table 6. 2

SELECTED CAPITAL PRICE INDICATORS

Year	Total producers' durable equipment: U.S.	Tractors: U.S.	Mining and oil field machinery: U.S.	Instruments: U.S.	Machinery and equipment: Canada	Non-residential construction: Canada
	No. 1	No. 3	No. 5	No. 17	No. 24	No. 21A
1926	69.5	85.5	57.7	95.6	63.1	60.2
1927	65.7	80.8	54.4	90.3	60.8	60.2
1928	65.1	80.2	48.0	89.6	60.5	61.5
1929	66.6	82.1	55.2	91.7	61.8	63.2
1930	63.8	84.1	54.6	88.2	59.3	61.0
1931	65.4	86.1	57.0	93.4	56.9	56.5
1932	70.8	96.6	60.9	110.4	56.8	54.0
1933	65.5	101.7	60.8	92.3	56.2	52.5
1934	61.6	84.6	55.2	84.5	55.7	53.1
1935	60.5	83.1	53.9	79.5	56.8	53.9
1936	60.6	82.0	54.1	81.0	57.4	55.3
1937	63.5	81.5	58.4	77.2	61.3	59.7
1938	65.4	79.5	59.9	78.7	61.3	58.5
1939	65.0	76.5	59.2	79.8	61.2	57.8
1940	74.0	84.0	68.8	93.7	65.7	60.0
1941	82.0	88.3	78.1	105.2	70.6	63.3
1942	89.4	91.0	83.3	111.9	72.8	67.9
1943	89.1	89.8	85.2	108.7	76.4	70.9
1944	89.8	87.1	86.4	104.0	75.3	72.0
1945	85.2	80.9	82.9	94.0	73.6	72.3
1946	82.4	76.1	79.3	89.3	74.5	76.7
1947	88.5	83.1	85.8	92.7	84.2	85.7
1948	95.0	92.8	93.0	98.5	94.4	96.5
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	108.6	108.4	111.3	108.8	105.7	105.7
1951	114.2	112.5	120.0	114.4	118.3	118.7
1952	108.2	107.0	111.8	105.8	117.8	127.1
1953	112.2	111.0	115.9	109.7	119.8	132.1
1954	113.0	111.7	116.7	110.5	120.9	131.7
1955	118.0	116.6	121.8	115.3	123.3	137.3

SOURCE: See Appendix C of this chapter.

or equipment made in the United States and imported to Canada. The others apply particularly to Canada.

The problem outlined immediately above is that of the inappropriateness of the available price indexes to the task of deflating industrial expenditures in detail. This price problem is probably in aggregate much closer to solution than that of *quality* changes in capital goods.

The quality change problem can best be exemplified by considering a commercial truck which in 1930 may have cost \$1,000. In 1949 such a vehicle may cost \$2,000. Since the price level in 1930 was about half of that today, the 1930 purchase *measured in 1949 dollars* would also be shown in our series as \$2,000. In other words, the volume of expenditure on com-

mercial trucks is shown to be the same then as now. From some points of view this estimate is perfectly acceptable. But if we intend our deflated series to represent the volume of expenditure on capital goods, we are conveying the implicit and dubious impression that a truck in 1930 is the equivalent of a truck in 1949, in capacity, speed, durability and general usefulness.

In this example we have confined our attention to widely separated years. In the deflation and cumulation procedures used in our over-all method, it was necessary to deflate the expenditures of adjacent years and to cumulate them so that the motor truck purchases of 1949 are added to those of 1950. The growth of the resultant estimate of the stock of machinery almost certainly understates the growth in the efficiency, carrying power or in the productivity of this stock. As quality is improved through new inventions, new materials and new methods of organization, expenditures which are equal in purchasing power represent, as time passes, increasing amounts of capital, when the word "capital" carries the sense of the amount of tangible material of given efficiency available to assist workers in the production of final goods.

In theory at least, two methods could be adopted to prevent the resulting understatement of the growth of the capacity of the capital stock. The first method would be to use a wide variety of individual price indexes that had been adjusted for improvements in quality. Unfortunately, such indexes are very scarce. In addition, even if they were plentiful, the statistician might be unwilling to accept the measurement of the quality improvement made by the author of the price index. In the case of consumer price indexes, quality improvements are often measurable by the extra amount of a particular material or the extra durability contained in the goods being priced. But apart from durability, improvements in the quality of capital goods can be measured only by judging the improvement in the productivity of such goods. The author of a price index, in other words, has to judge the usefulness of these goods over many future years in comparison with the usefulness of the type of goods which they replace. It is extremely unlikely that a statistician would be able to accomplish this task. If he were, he would be in the position of preventing all subsequent calculations of capital *productivity* from showing any improvement, since his manipulation of the price index would in a sense amount to assuming that the productivity of that kind of capital goods remains constant over time.

Since it is the ultimate purpose of most measurements of the capital stock to measure the productivity of capital, or of capital together with other expenditures by industry, it is desirable that the price index conform to some other convention. A convention which would be relatively simple to understand would be one which deflated annual investment expenditures by an index of wages and salaries. The resultant deflated series would then be an index of the number of men or man-hour equivalents contained in the capital stock. Deflation in this manner, however, would not be equivalent to produc-

ing a physical count of machines, since the prices of machines do not move uniformly with wage rates: indeed, since there is increasing labour productivity in making machines as well as in using them, prices of the machines would be expected to rise less rapidly than wage rates. The American statistician, Dr. George Terborgh, to whom we have referred previously, has in his work for the Machinery and Allied Products Institute compared the United States' machinery prices and wage rates. He estimates that the ratio of the machinery and equipment price index to the over-all United States wage index has declined at a compound rate of 1.08% per year. If this observation is accurate, and if, as is believed, it applies as well to Canada, at least roughly, then an investment expenditure series deflated by a wage index would understate the growth in the stock of real capital goods.

A compromise, which we have actually used, is to employ different types of price indexes in different circumstances. For the calculations of the present study, the price indexes are on the whole those which comprise the price deflators for the constant dollar Gross National Expenditure. Some of these deflators are specific to certain assets, motor vehicles for example. Most of them, however, measure simply *the changing cost of labour and materials* used in making various types of capital goods. For example, the structures' index represents a combination of the price movements of such materials as cement and structural steel, as well as that of construction labour. In earlier periods we have deflated machinery and equipment expenditures on capital used in generating electricity by a non-ferrous metal (i.e. copper) price index, and a general machinery series was deflated by the early wholesale price index for iron and its products.

In summary then, the deflation procedure, although applied in some detail by industry, and indeed by type of asset, is not an adequately satisfactory solution to the problem posed by the changed price of investment goods, because of the close interrelation between price changes and productivity changes of investment goods. It is very important that the deflation procedure followed achieve a conceptually consistent set of valuations of past investment expenditures. The price indexes and deflators which we used were the best selection available among what is at best a very small number of price indicators. It is to be hoped that in the near future the statisticians will be able to gather more detail and more consistent information about the prices of investment goods.

As things are now, we can only claim that our deflation procedure makes in aggregate fairly adequate allowance for the change in the price level of a more or less representative bundle of capital goods; but we cannot be sure that the changing relationship among the prices of different investment goods has made itself felt in our deflators, nor that we have achieved a uniform degree of accuracy of measurement of any one concept of price change (such

as price change net of productivity improvement, or price change including the effect of productivity improvement).

The reader should be warned that the deflation procedure may for certain industries and in certain years, especially during a depression or during a war, give results which are very far from measuring the change in the volume of capital goods. Because of offsetting errors and belief that the indexes succeed in measuring the generality of price level changes, these errors should be smaller, the greater the aggregation of industrial estimates and the greater the number of years over which individual deflated figures have been cumulated.

Let us turn now to the forecasting of capital expenditures. We argued in the early pages of this chapter that it was not satisfactory to attempt to forecast investment expenditures in Canada by merely observing the investment expenditures of previous years. This we said is because such investment expenditures were made not only to build up the stock of capital goods (in order to equip more workers, to turn out more goods, or to equip any existing workers with more tools), but also to replace those goods which, because of wear and tear or obsolescence, had been discarded within that period. The procedure we have described at length above is a method of determining how large the stock is, and also as a by-product, how much of the investment expenditure of a particular year is needed for replacement, and how much of it is available to raise the level of the capital stock.

In the forecasting procedure we focus attention upon the capital stock and the ratio of capital stock to output by the industry employing that capital stock. It is one of the existing and so far not completely explained regularities of economic life that the ratio between capital and output is a fairly stable one, especially during periods of full employment. Indeed, theories of economic growth have been produced recently, the central assumption of which was that the capital-output ratio would not change over long periods of time. Our own approach was discussed in Chapter 3.

What is necessary for the forecasting procedure is that we have some idea of the present magnitude of this ratio, its recent changes and its probable growth or decline in the future. To use with this forecast of the capital-output ratio, we have available from Chapter 5 the estimate of output itself which was produced independently of the capital forecast; that is, we have for the economy of a whole, and for certain industrial sectors, forecasts of the ratio of capital to output and forecasts of output. By multiplying the two together we obtain forecasts of the capital required at each period of the future. What remains then is to determine how much investment must take place between now and each future period in order to

(i) make good the loss of the investment goods that will go into discard as we proceed into the future;

(ii) build up the stock so that its magnitude is sufficient to satisfy the forecast capital-output ratio.

This amounts to pushing our cumulation calculations forward, but instead of adding expenditures and subtracting discards to discover what will be the capital stock, we begin with the forecast of the capital stock, subtract as discards the additions to the stock of earlier years, and discover what expenditures are necessary to make up the difference.

IV. *The Meaning of Capital*

In Part III we discussed the statistical means by which our estimate of the capital stock is derived. The purpose of the following part is to explore briefly the relationship between the resulting estimate and the aggregate which in economic theory is known as capital.

To begin, we may direct attention to the discussion in Part II of this chapter, of the two roles of capital: first, that it is income-generating (that is, that its creation leads to the employment of the factors of production and to their remuneration); second, that investment is capacity-creating (that is, that it provides the tools, equipment, buildings and structures which are of assistance to labour—indeed may replace labour—in producing goods for final consumption).

The first of these two roles is that which has been most emphasized in recent discussions of the instability of the economy, or in the slightly older discussions of the business cycle. Investment is viewed in these discussions as a source of employment.

The second, capital as a creator of output capacity, has a very long history in economic thought, culminating in the so-called Austrian theory of capital of the 1920's and 1930's. With the onset of the depression, however, capital theory of this type almost disappeared. Only in the last few years has the appearance of the equilibrium theory of growth of Messrs. Harrod and Domar and others led to a revival of interest in capital in its second role. Indeed, these recent economic theories of growth succeed in simultaneously emphasizing both roles of capital and, one suspects, confusing them.

This diminution of interest in the second type of capital theory during the depression of the 1930's is not surprising, for in this capital theory the question at issue is the allocation of output, capital goods and other goods, over periods of time. The fundamental premise made in studying this allocation is that there is a shortage of capital goods, and that it is an important problem to discover on what principles the use of available land, labour and capital shall be divided between production of capital goods and other goods in each period of time. During the depression, however, there was no shortage of capital goods, nor of the factors of production. Indeed, since, as our statistics later will reveal, there was a surplus of both, it could not be pretended that

the allocation of the use of capital goods over time was conducted according to rigid principles of economizing. This excess capacity in industry disappeared with the growth of population and the end of the cyclical decline in output; since the war economists have again turned to the problem of the principles underlying the relationships between the flow through time of usable factors of production, the flow through time of the output of final goods, and the stock of fixed and working capital (which we have already referred to as a reservoir or lake interrupting and regulating the flow of goods).

In the traditional theory of capital (that is of capital in the second role), the flow of goods and factors through time has been compared and juxtaposed to the willingness of the economy to postpone the consumption of things which are immediately available in return for the opportunity to consume them in different or augmented form at some later date. In this system of thought it is argued that businessmen are always anxious to invest the services of factors of production so as to gain from their superior productivity in the form of capital goods. Businessmen, in fact are so anxious to do so, that they are willing to pay a premium for such resources which is, roughly, the rate of interest. Consumers, on the other hand, are said to be unwilling to postpone consumption, preferring present enjoyment to future enlargement of their possessions. Unless they are paid a premium, which again is related to the rate of interest, they are unwilling to lend. Theory goes on to assert that a market mechanism exists which will bring into equality at a certain equilibrium rate of interest the amount that businessmen want to borrow for future use and the amount which consumers are willing to lend.

Determined by the market mechanism in this way, the rate of interest in turn gives guidance to individual businessmen as to how much investment they ought to undertake and what types of investment goods they ought to purchase. Their purchase of investment goods results in a demand for the output of the investment-goods industries, a demand for the factors of production which work in those industries, and finally, in the determination of wages, salaries, profits and rents received by those factors.

In the final grand structure of the theory then, the allocation of factors of production among industries, and over time, is generally determined simultaneously by the rate of interest, the availability of such factors, the opportunities for future profit to be made by businessmen, and the willingness of consumers to save. We have given this résumé of theory to emphasize that in the traditional approach to capital, the rate of interest plays an important, if not central, role.

In our own statistical approach, however, and indeed in much of the theory which was discussed in Chapter 3, the rate of interest plays a minor, and implicit, role. In equilibrium theory, businessmen compound the cost of past investments at the going rate of interest, and discount future net

revenues at the same rate. Hence, the value to them of their capital goods should be equal to both the compounded cost and the discounted value of their enterprise. Therefore, the fortunate statistician who wished to measure the value of capital of a firm that was in a state of equilibrium could indifferently measure the capitalized value of the future earnings of the assets or the cost of acquiring new assets less adjustment for wear and tear. But of course, in a growing economy, industry is never in a state of equilibrium. The marginal investment decisions will *tend* to equate the cost of a new machine to the sum of its discounted profits, but on much of his stock the businessman may be making a profit (quasi-rent) or a loss caused by the shortage or excess of equipment in the industry. The capitalization of this profit will indeed measure the value of the stock to him, but it will not give a clear indication of the volume of machinery. Indeed, when elements of monopoly exist in the selling of the product of the machine, a small stock of equipment may actually have a higher discounted value than a larger stock. Hence, in a situation which has not reached a state of competitive equilibrium, we cannot assume that capitalized values are a guide to the size of the stock of assets.

And in our statistical account of the annual position of industry's stock of capital, we cannot make the assumption of competitive equilibrium. As we have said, in a growing economy business is in the process of building up its stock of capital to the required level, or of divesting itself of unused goods by scrapping or by merely allowing items to wear out without replacement. In addition, innovation is constantly taking place, so that business can rarely be described as actually having an equilibrium stock of capital. It may be that the entire installed process of production is in some way different from that which would be desired in an equilibrium situation. Consequently, we must adopt from the outset the view that the cost of capital goods will diverge at any given time from the value of such goods to their owner; and that the divergence may both individually and in the aggregate rise and fall with changes in possible methods of producing profitable goods or services. Indeed, in studying the dynamic economy which our statistics describe, such divergences should be allowed to manifest themselves fully, because they are good evidence of the existence of forces leading to changes in the rate of growth.

In Chapter 3 we argued that the "equilibrium rate of growth" of the economy is, if analyzed more closely, a composite of the slow and rapid rates characteristic of the various phases of the business cycle. The difficulty of reaching competitive equilibrium that we have just discussed is another way of saying that businessmen attempting to acquire an equilibrium stock of capital will tend to overshoot and to undershoot their target. This process is both compatible with. and leads to the achievement of, the equilibrium growth rate of Chapter 3. We return to this discussion in the next part. when we review the meaning of the capital-output ratio.

This brings us again to the subject of the deflation of the original expenditures on capital goods. We saw in the earlier discussion that there were in theory several alternatives open to us in the deflating of investment outlays: deflating by actual price indexes of types of capital goods, by indexes of wage rates, or as most usual, by weighted indexes of the costs of materials and labour used in making capital goods. From the above discussion it emerges that we should avoid any method which would depend upon owners' evaluation or periodic revaluation of their assets based on discounted expected profits. For such a method would not present data on the costs of installing new machines (i.e. price indexes relevant to new investment) except insofar as the general price mechanism rapidly equated the supply price (and the cost) of new machines to the owners' valuations of existing machines. There are undoubtedly forces at work in the economy which would bring this equality about (for example, by adapting old machines to a new purpose, and by turning to the second-hand market), but we may doubt that they work rapidly. It is more probable that in the short run machinery and equipment suppliers continue to charge customary prices, instead of continually changing them to take advantage of relatively small fluctuations in demand in particular purchasing industries. That is, the actual price of a new machine may at any given time be out of line with the value of existing machines to their owners. Hence, owners' valuations are not the best measure of the cost of new machines.

Therefore, in following the deflation procedure for measuring changes in the volume of new goods installed, we should attempt to measure the prices of such machines to their buyers. As mentioned in the notes on deflation method, we are not rich in historical records of such prices. We suggested there that good approximations were the D.B.S. indexes constructed by combining series on the cost of materials with relevant wage rate information. We should add to our previous observations on the assumptions involved in our use of the data the following two: that the suppliers of capital goods are assumed not to charge all that the traffic will bear; and that although suppliers may enter or leave a market as demand changes in the short run, the price charged continues to reflect chiefly the price of labour and materials available to the industry. (This point about "price rigidity" is essential in some mathematical models of the economic process. It is introduced for example, by R. M. Goodwin, in "Econometrics in Business Cycle Research", in A. H. Hansen, *Business Cycles and National Income*, New York, 1951, p. 446.)

In less profound ways, too, our gross and net stock estimates each differ in concept from the capital of economic theory. In theory, capital is any stock of past goods and services, regardless of the economic organization which uses it, and regardless of the period of time which any given item is assumed to remain in the stock (the rate of turnover). The theoretical concept, there-

fore, must be thought of as including inventories, social and institutional, fixed and working capital, and consumers' durable goods. Some scholars have argued that these types of capital are not "productive" in the same sense that fixed capital goods owned by industry are productive, but it is hard to understand this point of view. Each establishment of each firm must hold stocks of raw materials and of produced goods unless it is wastefully to slow down or accelerate its rate of production in the attempt to achieve a situation in which the rate of output is exactly equal to the rate of shipment from its doors and the rate of input is exactly equal to the rate of arrival of materials from their sources. This procedure would undoubtedly mean also that a wastefully large amount of goods would be "in process" at any one time.

As for social capital, it would seem to be just as productive as private capital. From the point of view of the statistician, it is an accident of politics that roads are social while railroads are private, and it is easy to think of other countries where both are private, or both public.

The main body of this investigation, however, is an attempt to see how much capital is used by each sector of the industrial economy and how that amount is changing. For this purpose we may *temporarily* ignore the fact that all sectors also hold inventories and use capital owned in common by the whole nation, and confine our attention to the fixed capital stocks which so strongly differentiate the sectors. When this has been done, we must then turn to a review of the rest of the national capital structure, fixed, variable and social.

Another way of looking at this subject is to say that an economy such as ours working at full employment not only needs various types of fixed capital, but it also needs to hold stocks at various points in the process of production and distribution. It is a matter of little statistical interest that in some societies many such goods are held by manufacturers, whereas in others retailers or consumers perform most of the stock-holding function. Our purpose is to find the size of the stocks. (Though it should be pointed out that in a long-run investigation of growth, such as this study, the pronounced fluctuations in inventory investment are much less important than in a study of year-to-year economic stability. Over the long run inventory stocks are a relatively stable percentage of the national output.) Again, in some societies many of the stocks of fixed capital are held by public institutions, whereas in others the same types of goods are owned by private business. Once again, our interest here is more in the quantity of such stocks than in their ownership.

There is another category which is not covered by our investigation: the "stock" of natural resources. Capital theory has always been equivocal on the question of defining natural resources: sometimes they are classified

with land as a permanent and undepreciable asset; in other cases they are grouped with the capital stock of the economy. To us it seems that from the point of view of the productive process in the economy, natural resources are in most respects identical with capital goods. They provide the labourer with the assets he requires to produce final goods; and in many processes they are substitutable for invested capital. Therefore, taking the economy as a whole, a dearth of capital goods can be made good by a rich supply of resources, or vice versa. Furthermore, the disappearance of physically irreplaceable natural resources must be compensated, if income is not to decline, by the investment of the fruit of such resources in other types of capital good which, in effect, keep the total capital structure of the economy at the appropriate level. A visitor from another planet would be puzzled to understand why forest and lands were referred to as natural resources, while the replacing capital goods were referred to as capital, since both perform the same function.

However, in the present investigation we have the statistical difficulty that natural resources could only be measured by discounting their future profitability. Since they have not usually been installed by man, nor set aside through his thrift, they are statistically incommensurable with our fixed gross stock and net stock estimates which are measured by cumulating the costs of the original expenditures.

In the calculations explained in Part III, we showed that the cumulation or perpetual inventory method could be used to derive estimates both of net stock and of gross stock. A few words on these two concepts and their respective relation to capital and to production theory may be appropriate here.

Gross stock, as will be apparent from the outline of the calculation method, is an estimate very similar to that produced when making an estimate of a human population, in that the investment in new goods is treated statistically in the same way as the birth of an individual. The item and the individual are both presumed to remain in the "population" until the average life expectancy has elapsed. Once a population (or gross stock) estimate has been established, the statistician has only to adjust it annually for the births and deaths which occurred in the preceding year.

It appears from this explanation that the gross stock figure measures the number of capital goods that are actually in place. As with the human population just described, no account is taken of the age or other characteristics of the members of the population. Just as the mere population total of Canada does not tell us how many people are in the labour force and how many are retired, so the gross stock figure does not reveal how many machines are actually at work as opposed to those which produce output only at high labour cost, or which have been "downgraded" to unimportant tasks.

One essential difference does emerge, however. A population of individuals may exhibit over time wide variation in the proportion of it which is in the labour force. Both the gross stock, however, and the net stock figures, while not revealing the *intensity* of use of the various items within it, nevertheless are intended to measure the number of machines actually available for work, however inefficient or unsuitable some may be. Indeed, during a depression the productivity of many machines may be zero.

The net stock, as the calculation method shows, in effect displays not only the size of the population of capital goods, but also the effect of its age composition. In our estimate of a population of individuals, we may wish to show how many people are in each of 15 or 20 age classes. The net stock, in effect, shows the average of such an age distribution by employing a reduced valuation for older goods.

This reduction in valuation is identical in concept to the depreciation of capital goods by commercial enterprise for purposes of estimating profits. It may arise for two reasons: in the first place, the capital goods being measured may gradually be decreasing in their efficiency in producing final products. At the same time, similar goods may be maintaining their efficiency in turning out final product, but they may require higher maintenance expenditure, more skilled operation or replacement of vital parts. Because of these declines in productivity, or in cost saving ability, the value of such machines naturally falls year by year, if value is interpreted to mean the amount which a willing purchaser would offer for such items in a competitive market.

In addition, the value of depreciating machinery may fall for quite a different reason. It may be that, like the Wonderful One-Horse Shay of literature (so often cited in these discussions), the machine or building under consideration maintains its efficiency and cost-saving ability throughout its entire life, then, as it were, disintegrates completely within the final period. Such an asset will, like those which are gradually losing their productivity, also decline in market value, not because of any physical defect, but because the present value of its future profit earning capacity falls as the expected year of disintegration approaches.

These two cases are extremes. The depreciated value of an actual item in use by a firm presumably falls for a mixture of the reasons exemplified by these two cases. Indeed, accountants and engineers have given some attention to the actual way in which value and productivity of various types of asset fall over time, and the method of cumulation of actual expenditures by Dr. George Terborgh (referred to in Part III) requires a generalization of one of these time-paths of value decline to the economy as a whole.

As between net stock and gross stock, there is little value in attempting to decide which of these two approximations to the capital concept of economic theory is better. Each of them has a place, and most theorists are unde-

cided even as to which of the two is the more valuable in a particular situation. We may tentatively suggest that the net stock figure is closest to that shown in a corporation balance sheet after the reserves for depreciation have been deducted from the cost of the assets. It is, in effect, an approximation to the value that the corporation could receive if it liquidated its assets on the open market. In brief, we may say that the net stock is of particular interest to those who would study the financial or balance sheet structure of industry.

The gross stock, on the other hand, seems to us to be most valuable when discussing capacity and the productivity of capital. We are impressed by arguments that most capital goods do retain most of the efficiency of their early years until they are finally discarded. Indeed, with respect to machinery and equipment the rapid onrush of obsolescence and the stiff competition which exists within industry between rival users of machinery and equipment suggests that there is every incentive to discard such items as soon as their efficiency begins to decline. That is, the average service life that we have used may be considered as representing that period within which equipment retains its original efficiency.

Plants and buildings as well certainly do not lose their efficiency as rapidly as the straight-line depreciation implicit in the net stock would suggest, though in their later years they may be more expensive to maintain.[4]

There is another reason for believing that the gross stock presents a reasonable estimate of the capacity of industry. The point is complex, but an example may clarify it. It may be that a certain group of machines, though still in use, is declining in efficiency: it must be run at low speed, or/and requires large maintenance outlays. To the extent that owners *accept* these slow rates of output and high costs, the gross stock figure (because it neglects the depreciation that is the accounting counterpart of such decreased efficiency) overstates the capacity of industry. But if owners *avoid* this inefficiency, they will replace the most cost-raising parts of their equipment and add new attachments. These actions all imply new investment, which will add to the gross stock.

The reader may object that a measurement which actually shows an increase in capital when investment has taken place merely to avoid a decrease in net output is hardly suitable for measuring "capacity". The answer is, as usual, that a measure's suitability depends upon how it is to be used.

Usually, measures of capital are not used by themselves. There is little interest in the absolute value of the capital estimate, though its rate of growth is relevant to many studies. What is more interesting is its rate of growth in relation to the rate of growth of production and the labour force. Such

[4]See Philip Redfern's "Net Investment in Fixed Assets in the United Kingdom, 1938-1953", *Journal of the Royal Statistical Society*, Vol. 118, 1955. On. p. 143 he notes that net measurements "take account not only of changes in the quantity of assets installed, but also of changes in their unexpired lives—a two dimensional concept; whereas measures of productive capacity or quantity of assets in place are essentially one dimensional".

relationships are illustrated by changes in the capital-output and capital-per-worker ratios.

Now, if a decline in efficiency takes place, the capital-output ratio will initially rise, because for a given stock, output net of operating costs will fall as extra expenses of operation are incurred. In other words, the fall in efficiency is measured by the rise in the capital-output ratio. And if, on the other hand, the owners do not accept the rise in operating costs, but instead replace and augment parts of their equipment, gross stock will increase but (net) output will remain the same. The capital-output ratio will still rise.

If the net stock measurement of capital were used, the initial fall in net output due to higher operating costs would be paralleled by a fall in net stock due to accumulated depreciation deductions. Since this would mean only a small change in the capital-output ratio, the decline in the average productivity of capital would be less noticeable than if the gross stock measurement were used.

Our cumulation procedure not only provides us with estimates of net and gross stocks, but also with a measure of depreciation, replacement and gross investment net of replacement. Because of the arbitrary assumption that all goods of one type purchased in a given year are discarded "L" years later, the year-to-year fluctuations of the replacement series, and of the gross-investment-minus-replacement series, are not particularly valuable to us. The long-run trend of this series, however, can illuminatingly be compared with that of gross investment and that of investment net of tax-allowed depreciation.

There is a considerable body of literature on the relationships among the rate of growth of gross investment, depreciation and replacement. These relationships may be stated very precisely on a variety of interesting assumptions, but the general conclusion can be arrived at by means of some intuitively evident propositions.

The general conclusion referred to is that depreciation allowances exceed replacement requirements in growing economies or in growing firms. In order to demonstrate this conclusion, let us consider first the situation in a firm which is not growing, but which has a large number of machines in use. If we assume that an equal number of these machines go out of use every year through obsolescence or wear and tear, that they are replaced by similar machines of the same cost and life (L) and that the capital cost of all machines is amortised by straight-line depreciation, it will be seen that on the average 1/Lth of the original cost of the gross stock will be put aside in depreciation allowances each year. At the same time, 1/Lth of the gross stock will need replacement each year. In other words, the depreciation allowances set aside each year will just be sufficient to purchase the replace-

ments required in the same year. (If an emergency should make it advisable to retire more than 1/Lth of the gross stock in a particular year, the enterprise would have to obtain funds elsewhere than from depreciation allowances to purchase replacements.)

We may contrast the above stationary situation with that of a growing firm. If the machines used by the growing firm are similar to those of the stable enterprise, the firm will each year be buying some machines to replace those which were installed L years earlier, plus other machines to enlarge the capital stock. Hence, each year the number of machines *which must be replaced* is equal to the number installed L years ago, but since the purchases have grown since then, the number of machines casting up depreciation allowances is more than L times the number installed L years ago. Therefore, the total depreciation allowance for a year (1/Lth of the gross stock) will exceed the cost of the number to be replaced, depending upon how rapid the recent rate of growth has been. Regardless of how much the excess is (which can easily be determined mathematically), we can assert that the firm will each year be able to finance from each depreciation quota more than the number of machines requiring replacement per year.

This principle is now well established, and we find business economists advocating manipulation of the permissible depreciation rate for income tax purposes as a method of encouraging or discouraging business investment throughout the whole economy.[5]

Of course, if the price level is rising at the same time the rate of investment is increasing, the depreciation quotas based on the gross stock measured at original cost may be inadequate to finance replacement, let alone further growth. The articles by Schiff and Eisner discuss the important effects of the changing price level on replacement.

It may be useful here to draw together the discussion of the meaning of capital in Part IV.

We have seen that within the body of economic theory the primary task of the theory of capital is to determine the principles upon which the services of the factors of production are allocated among their various uses and among various periods of time. This theory conceives of the factors of production as being invested for future use by being converted into more or less durable form. In this view, capital is the total stock which exists in any time, although this stock may be composed of flows of various types of goods and services, each of which is destined for ultimate consumption at a different future period.

[5]See particularly Evsey Domar, *Quarterly Journal of Economics*, November, 1953; Richard Goode, *ibid.*, May, 1955, and the other articles cited therein. See also Eric Schiff, *Review of Economics and Statistics*, February, 1954, and Robert Eisner, *American Economic Review*, December, 1952.

Our statistical concepts of net and gross stock are obviously too modest, both in conception and in refinement of method, adequately to measure this complex theoretical notion of capital. For example, while the theory of capital begins with the investment of factors of production, our gross stock measurement begins only with the purchase by an industrial user of an already completed machine (that is, one which is several stages past the investment of the services of factors of production). Indeed, in only one essential does our measurement of capital correspond with that of theory. This essential is the recognition that capital does consist of a stock of resources of different durabilities. There is more than a casual relationship between L (the lifetime of a capital good) and the "period of production" concept used in some varieties of capital theory.

However, as commonly understood, capital theory has much less to say about the situation in an economy during periods of adjustment than it has about the ultimate equilibrium of resource allocation over time when the adjustment is complete. It is here that our measurement of the gross stock diverges most from this common understanding of the capital theory explanation of how, in an economy (which is for all purposes stationary), the allocation of the services of each factor of production and of each capital good is in harmony with the decisions of members of the economy to save and with the realization of the services of durable goods and services over time. When such a closely defined equilibrium has been reached, theory is consistent with a fixed and stable rate or spectrum of rates of interest, and with a system of prices for each factor, good and service available at each period of time. Such a stationary equilibrium cannot exist when the economy is subject to the shocks of innovation, war, crop failure, population change and rapid development of needs and tastes.

Obviously, such dynamic conditions do exist in Canada today, and have existed over the 30 years covered by our data. At any given time the combined forces and after-effects of growth, war and depression have forced savers, consumers and business men to make the best adjustment possible *in the existing situation,* without making preparation for an eventual static equilibrium, although, as we suggested above, their efforts are compatible with the appearance of an equilibrium rate of growth.

Such a dynamic unstable environment has meant that throughout the economy there have been greater or lesser disequilibria in the structures of prices and interest rates. Instead of experiencing marginal adjustments as businessmen attempt to make small additions to their profit, the system has moved with great leaps to incorporate new methods, to supply new demands, and to make good the losses of wars, depressions and crop failures. In particular, in such an environment we cannot expect that the cost of new capital goods will be particularly close to the value of existing goods already in the hands

of owners; nor will there be a close correspondence among the cost of new capital goods, the marginal profitability of all capital, and the rate of interest.

In this situation it is not only expedient but necessary that the analyst of the stock of capital abandon many of the precepts of capital theory and return instead to working methods developed in similar situations by accountants, for our investment cumulation method has much more in common with the inventory valuation systems of cost accountants than it has with the theories of Wicksell, Böhm-Bawerk, Frank Knight or Hayek. (It must be mentioned here, however, that there are several economists who have emphasized the "population" view of capital theory. Among these, today, are Kenneth Boulding, following in this respect an approach developed and emphasized by J. B. Clark. Against this approach, Mrs. Joan Robinson, writing on "The Production Function and the Theory of Capital" in *Review of Economic Studies,* No. 55, page 81, has re-emphasized the heterogeneity of capital goods and their incommensurability.)

V. *The Record*

In this section we wish briefly to examine the record of capital in Canada. As the reader will gather by reference to Appendix B, we have gathered an enormous amount of data which can be analyzed in many ways not least with respect to its accuracy; thereafter with respect to its relationship to the growth and the level of other measures of economic activity.

In this section we shall discuss some features of the growth of capital—some other aspects of this growth have been sketched in Chapter 2. and more will appear in our comments on forecasting assumptions. Beyond this, we wish here to draw attention only to three aspects of the new estimates of capital stock. The first of these is the capital-output ratio and its change over time. The second is the relative importance of machinery and equipment. The third is depreciation.

1. *The Capital-Output Ratio*

In Chapter 2 we saw that in contrast to some of the other ratios to be observed in a growing economy, the capital-output ratio maintains an extraordinary stability over time. This is true, not only for Canada since 1926, but also for other countries.

In the United States, for example, Goldsmith notes "the absence of any pronounced trend in the average national coefficient . . . for the period 1897 to 1929. What fluctuations are shown in the ratio appear to reflect mainly the cyclical movements of real net national product. When comparison is limited to years of full employment, it is difficult to detect any movement in the ratio".[6] For the second half of the 19th century, Fellner claims some

[6] *Income and Wealth of the United States,* Cambridge, England, 1952, pp. 297-298.

slight upward drift in the ratio (see Table 6. 3). This impression in corroborated by Handfield-Jones and Weber, who conclude "through 1894 to 1939, the long-run trend of the capital coefficient based on capital formation data, is best summarized as horizontal but if the lower values in 1879, 1884, and 1881 are included, it could equally be regarded as moderately rising".[7] The more recent studies of Dr. George Terborgh suggest an equivalent stability in the American ratio between 1946 and 1955. However, the work of all these authors suggests that the ratio today is appreciably below that of the middle 1920's.

Table 6. 3

UNITED STATES: CAPITAL-OUTPUT RATIOS[a] 1874-1950

Period	Capital-output ratio
Decades	
1874-83	2.85
1884-93	2.98
1894-1903	3.39
1904-13	3.39
1914-23	3.75
Years	
1929	3.26
1950	2.7

a The capital (net) stock figure excludes land and consumer durables and includes government fixed capital and net foreign claims. The output figure is the *net* national product. All data adapted by Fellner from Simon Kuznets, *National Product since 1869,* New York, 1946, except that for 1950, which is Fellner's estimate.

SOURCE: William Fellner, "Long-Term Tendencies in Private Capital Formation", in *Long-Range Economic Projection,* New York, 1954, p. 306.

Over the long run it might be suggested that the American capital-output ratio rose slowly between the Civil War and the early 1920's, and declined rather more rapidly to its present value. This suggestion is confirmed by a study by Daniel Creamer, who finds that for manufacturing alone (not the entire American industrial economy) "the amount of capital invested per dollar of output rose steadily from 1880 to 1914, according to the record of reported values . . . . The amount of capital invested per output dollar began to fall in 1914 and continued until 1948". Creamer suggests that in constant dollars, 1919 may be the peak rather than 1914.[8]

For the United Kingdom, a similar stability in the ratio has been noticed. A study by Phelps Brown and Weber of the period from 1870 to 1940, finds that "over the whole span, capital has grown at about the same rate as income: both real capital a head and real income a head have nearly doubled . . . . The capital coefficient or ratio of capital stock to annual income flow has been stable, but declined from about 3.7 in the seventy's to 3.3 in the

[7] "Variations in the Rate of Economic Growth in the U.S.A. 1869-1939," *Oxford Economic Papers,* June, 1954, p. 113.

[8] *Capital and Output Trends in Manufacturing Industries, 1888-1948,* N.B.E.R. Occasional Paper No. 41, 1954, p. 42.

ninety's, and rose again to 3.9 in 1912. In the interwar years, it moved from about 4.0 to 3.6".[9]

The situation is rather more difficult to describe for Canada, because the data are available only since 1926. Our calculations suggest, however, that the gradual decline in the ratio noted by the American observers for the period since World War I applies also to Canada, although the reasons for this need not be the same. From 1926 to 1930 the ratio had a typical value of 3.0, and in the recent postwar period it centers around 2.4. This is indeed a conspicuous decline, part of which may be questioned because of statistical inadequacies in the data. Rather than at this point try to explain the decline, we should like to emphasize instead the short-run stability of the ratio, which Table 6. 4 may serve to illustrate.

Table 6. 4

CANADA: INDUSTRIAL FIXED CAPITAL 1946-55

Year	Fixed investment/G.N.P. (percentage)	Fixed capital/G.D.P. (ratio)
1946	8.7	2.33
1947	12.1	2.33
1948	13.1	2.36
1949	13.1	2.42
1950	12.5	2.37
1951	13.5	2.33
1952	14.3	2.33
1953	14.3	2.35
1954	13.6	2.55
1955	12.5	2.40

SOURCES: Chapter 6, Appendix B, Tables 6B. 1 and 6B. 2; Chapter 5.

It will be seen that, in the period of the postwar revival since 1946, fixed industrial investment, as a percentage of G.N.P., while it has been steady and on the whole high, has varied from 12% to over 14% of the G.N.P.

However, such variation in the rate of investment has little effect on the stock of capital, since at the present time the stock of capital is approximately 30 times the investment of any one year. The year-to-year fluctuations in the capital-output ratio, therefore, are chiefly a reflection of the year-to-year instability of the denominator of the ratio, the national income. To be specific, the relatively high figure for 1954 is almost certainly a reflection of the fall in G.N.P. in that year.

This stability should not be interpreted as asserting that for statistical reasons there is *over the long run necessarily* greater stability of the capital-output ratio than of the investment-output ratio. Over the long run annual

[9] "Accumulation, Productivity and Distribution in the British Economy, 1870-1938", *The Economic Journal*, June, 1953, page 266.

fluctuations in the rate of investment may average out, and if savings as a percentage of output are more or less constant, it may be (depending on foreign investment) that the investment-output ratio will exhibit greater stability than does the capital-output ratio. This is the subject we are to investigate. What the statistical stability of the capital-output ratio does imply is that we can, from year to year, especially when growth is going on, ascertain within a relatively short period of years the actual value of the capital-output ratio. On the other hand, a short period of years may exhibit such relatively wide fluctuations in the investment-output ratio, that the forecasting statistician may be required to average a distribution of percentages with a very wide range.

The considerations above are based chiefly upon the statistical record. We turn here to enquire into the meaning of the capital-output ratio, and the meaning of changes in it.

First we may consider the ratio as a measurement of the productivity of capital (actually it is the inverse of capital productivity, since a decline in the ratio implies, other things being equal, a rise in productivity). Thus, if the capital-output ratio is observed to be rising over time, it means that the capital stock is rising more rapidly than the output of capital. Therefore, for the economy as a whole we can say that succeeding additions to the capital stock produced additions to the flow of output which were smaller than previous increments have produced. However, as is also to be observed, the changes in the capital-output ratio over time are fairly slow because it represents *average,* not *marginal,* productivity. That is, it is not a record of the ability of the most recent additions to the stock to produce output in comparison with the ability of units already in place. Rather, the ratio measures the ability of the entire installed stock of plant and equipment to turn out the annual flow of goods.

The ratio is not necessarily a measure of the *rate of profit* on capital. The ratio is calculated by dividing the value of the stock of capital by the value of the flow of goods. Some part of this flow of goods may be described as profit, and the rest of it is payment to labour, taxes, depreciation and rent. Thus, although the productivity of capital may be increasing, we cannot know whether the rate of profit on capital is also increasing unless we know whether the share of profit in the national income is remaining constant.

In theory we should be able statistically to derive the record of the rate of profit from the *marginal* capital-output ratio, but such theory is applicable only in a situation where the prices of all factors of production remain unchanged, and where technology is unchanged. While it is indeed probable that the volume of profits increases when the productivity of capital increases, we cannot conclude that the percentage rate of profit on capital has also increased

without further information about the share of wages, etc., in the national income.

The second way of looking at the capital-output ratio is to view it as an indicator of the need for capacity to produce a certain flow of final goods and services. This view is the foundation of many of the recent theories of equilibrium growth with which the names of Harrod and Domar are associated.

These theorists and the many others working in this field have in a sense taken the long period stability of the ratio as a datum, and have argued that if, for example, the ratio is 2.3, every increase in the G.N.P. of one dollar will require \$2.30 worth of capital to produce it. It follows that if steady growth is to be assured, investment must be steadily forthcoming to maintain this ratio, otherwise additions to the labour force will be under-equipped, and probably unemployed.

The opposite outcome is also to be feared if more than \$2.30 worth of capital is installed per dollar of output. For every anticipated \$1.00 increase in output there will be an excess of capital which will produce the following disastrous trend of events: in the next period the incentive to invest will be reduced by the surplus of capital already installed; the reduced incentive to invest will lead to an actual decline in investment; the decline in investment will lead to unemployment in the construction and machinery industries; this unemployment will be multiplied and generalized throughout the whole economy, so that total output will fall; finally, the reduced output and employment will lead to pessimistic anticipations of the future need for capital.

It will be observed that some have found an assumed constancy in the requirement for industrial capital in relation to the output of industry a useful foundation for theoretical speculation about economic instability. We commented on these theories in Chapter 3.

Our understanding of the capital-output ratio may be extended by asking what effect various changes and developments in the economy as a whole may have upon the ratio that the statistician can observe. In the following paragraphs we will discuss the probable effects that five outside forces may have, but it should be emphasized that these effects are not independent. Indeed, as Chapter 3, on the theory of growth, has emphasized, each one of the forces listed below will have an impact upon each of the other forces as well as upon the capital-output ratio, which is after all merely an observable symptom of changes going on throughout the whole economy.

Further, it should be emphasized that in some paragraphs we are talking about the capital-output ratio applicable to a particular industry, whereas in others we are talking about the whole economy. In this connection then, it is worthwhile to recall to the reader the discussion in Part IV, where we emphasized that we were attempting to ignore, in our inventory of the

total capital stock, questions of whether certain kinds of capital goods were owned and operated as a service by independent industries or by using industries on their own account. To be specific, we were ignoring whether a railway was run as a common carrier by private owners, as a common carrier by the government, or as a private carrier in a particular mining venture. Obviously, it makes a great difference to conclusions about the capital intensity of a certain final product whether the transportation of that product has been the responsibility of an independent carrier or of the industry manufacturing it.

The *first* of the forces operating on the capital-output ratio is the size and richness of the stock of natural resources. The political economists of the 19th century reasoned that since the stock of land and resources was limited, it would be necessary, if growth took place, to augment the capital stock to keep pace with the declining fertility of marginal land. Today it is still a valuable generalization that the most accessible resources are exploited and exhausted first, if demand remains constant. It is then necessary to turn to less rich or convenient material sources, the winning of which may require massive capital investment, and even in agriculture it is certain that the greatly increased output of food of the past years and the increase which is anticipated for the future could not and cannot be achieved without farm machinery, irrigation, drainage, and transportation facilities, not needed for the outputs of a generation ago. (We are aware that much of the recent farm mechanization has had the function of replacing scarce labour rather than intensifying the use of the land. It is impossible to distinguish statistically the labour-saving characteristics of new machines from their crop-increasing characteristics. We wish here merely to point out that the latter have been important objectives of farm policy.)

Such reasoning in the classical mood, however, is to a large extent offset by the large new discoveries of natural resources, by new crop and livestock varieties, and by the action of the price mechanism in turning demand from inaccessible or poor resources to more conveniently obtained materials. This collection of forces may, over time, mean that the net output of goods from natural sources will be possible with a smaller stock of capital goods per unit of output.

Our own judgment would be that as far as Canada is concerned, such new discoveries are not in fact reducing the capital-output ratio in the resource industries. Without consulting the statistics, it is patent that the forest and mining industries are going farther and farther afield so that even if their new locations are as rich as those abandoned, the costs of transportation are probably higher. In the hydro-electric field, locations long known but regarded as unprofitable are now being eagerly utilized in spite of their higher cost of capital per dollar of output. This belief is confirmed by the

capital-output ratios for structures. Of the six industrial sectors, only the resource industries' ratio has shown an increase since 1945.

The *second* force is one which is less equivocal in its effect, especially in Canada: indivisibilities and the economies of scale in a growing society. Reference here is to types of capital goods which from the outset are so massive and so indivisible that the demand for their services is probably less than the capacity for which they were designed. This description is mainly true of transportation facilities such as railroads and long-distance highways; it applies also to methods of communication such as telephone and telegraphs, radio, post office, and printing and publishing. The mining industry, electric light and power, and the business of government, may also exhibit this characteristic. It is probable that much of the recent decline in the Canadian capital-output ratio has been caused by the improvement in the degree of utilization of facilities such as those described above, but it must not be forgotten that such economies of scale eventually peter out under conditions of rapid growth. It is then necessary to install new projects which may once again be larger than the immediate demand would warrant. When this happens, the capital-output ratio may take a sudden jump upwards. However, as the economy grows, the effect of any one such indivisibility on the capital-output ratio will probably decline.

The *third* force at work on the capital-output ratio may be described as a change in the industrial composition of the national output. That is, there may be a reduction in demand for the output of agricultural goods accompanied by an increase in the demand for manufactured goods. As far as the national capital-output ratio is concerned, this change in demand may imply an increase in the ratio, if manufacturing requires more dollars' worth of capital per dollar of output than does agriculture.

This force is an easy one to describe hypothetically, but it is difficult to isolate in fact.

The work by Creamer, previously cited, examines for manufacturing in the United States (not all industry) the effect of the change in the structure of total manufacturing on the aggregate capital-output ratio for manufacturing. Speaking of the rise previously mentioned in the ratio for manufacturing between 1880 and 1919, he says that only about one-sixth of the rise can be attributed to the altered composition of the manufacturing total. "This is equivalent to saying that throughout the structure of manufacturing industries, basic changes occurred in the relationship of capital to output during the years 1880 to 1919."[10] Creamer then turns to the years from 1919 to 1937 when the over-all ratio declined. In respect of this period he concluded "the decline in the actual ratios occurred despite the changing composition of industry . . . . Again the inference is clear for the period of

[10]Creamer, *op. cit.*, pp. 57-58.

declining ratios. It is a trend that has characterized most minor industry groups" (page 60).

Creamer also examines the hypothesis that the tendency in the United States for manufacturing firms to grow in size had an effect on the capital-output ratio of all manufacturing taken together. There appears to be some ambiguity in the way data on this very ticklish question may be interpreted, but on the whole Creamer's conclusion is that the changing size of firm had a "neutral" effect on the over-all capital-output ratio.[11]

This problem has also been studied by Simon Kuznets in his "Long-Term Changes in the National Income of the United States of America since 1870".[12] Observing the increase in the ratio from 1870 to the 1920's, Kuznets—like Creamer—attempted to find how much of this increase was due to a shift from industries with low ratios to industries with high ratios. Unlike Creamer, however, he was dealing with the whole economy, which he divided rather crudely into four sectors. It is important to note this crude division of sectors, because the less fine the sectoring (the sectoring could be carried down to the individual firm in the final extreme), the less one expects to find that the change in the over-all ratio is due to a change in the industrial composition of the economy. We may paraphrase Kuznets' conclusions as follows: the shifts among the industries account almost wholly for the rise over the period in the ratio of fixed capital to product in the economy at large. Even from the 1870's and 1880's to the 1920's the ratio increased by four-tenths of its initial level, or 29 points.

Table 6. 5

UNITED STATES: INTER-INDUSTRY SHIFTS AND THE CAPITAL-OUTPUT RATIO

Decade	Index of capital-output ratio	Index of ratio inter-industry shifts	Index of ratio intra-industry shifts
	(2)	(3)	(4)
1874-1883	71	81	88
1884-1893	79	85	93
1894-1903	93	87	107
1904-1913	95	95	100
1914-1923	100	100	100
1924-1933	100	99	101

SOURCE: Simon Kuznets, *Income and Wealth of the United States, Trends and Structure*, op. cit., p. 127.

This will be seen in columns 3 and 4 of Table 6. 5. The inter-industry shifts produced a rise of about 19 points; the intra-industry one of only 12 points. What in fact happened, was that the rise in the intra-industry ratios in agriculture and the mining-manufacturing sectors was largely offset by the

[11]For a recent study, see H. S. Davis. "Relation of Capital-Output Ratio to Firm Size in American Manufacturing: Some Additional Evidence", *Review of Economics and Statistics*, Vol. 38, August, 1956, pp. 286-293.

[12]*Income and Wealth of the United States, Trends and Structure, Income and Wealth, Series II*, Cambridge, 1952.

decline in ratio in the transportation and the public utilities sector. Hence, whatever rise occurred in the country-wide ratio could have been due largely to the effects of inter-industry shifts in the distribution of national product—away from agriculture and in favour of the public utilities sector.

Kuznets points out that while much of the change in the country-wide ratio was due to this shift from one industry to another in the origin of the national product, there was at the same time a change in the ratios in each of the industries. The striking movements of these ratios within industries, as exemplified by a decline of the ratio for the transportation and public utilities sector, are evidence of the difficulties of assuming constant inter-industry differentials, and placing too much emphasis on mere difference in industry weights. They also suggest variability even in the country-wide capital-output ratios over time (pp. 128-131).

The available evidence for the United Kingdom does not permit a com-comparison of the 19th or early 20th centuries with the postwar period. Recent work by Philip Redfern does, however, enable us to examine the industrial distribution of capital in 1952. We paraphrase first a summary of his calculation of the capital-output ratio in different industries. The gross capital employed in public utilities (gas, electricity, water, railways and postal and telephone communication) was over six times their net annual output. For railways and electricity the ratio was some 15 times, and for water 46 times. For the manufacturing and distribution groups, however, the gross capital employed was only 1.8 times the annual net output. Despite serious qualifications about industrial classification and the quality of the figures, Redfern concludes that there was a clearly indicated heavier capital requirement per unit of output in the public utility field than the manufacturing and distribution field.

In the postwar period Leontief, for the United States, and our own calculations for Canada, confirm this great difference in ratios as among industrial sectors. We can indicate this roughly by using data collected (for quite another purpose) by R. N. Grosse in *Studies in the Structure of the American Economy,* New York, 1953, Appendix 1. We have classified the data for some 80 industries on output and fixed capital stock (defined in terms of capacity) into sectors similar to our own. Table 6. 6 shows the relative importance of each sector in terms of fixed capital, and the size of its capital stock. Housing is omitted; the difference in dates should be noted.

The absolute differences in the values of the ratios are not particularly informative, since the methods and concepts used in the two studies differ greatly. It is significant, however, that transport (particularly railways) utilizes a much larger proportion of Canadian fixed capital than of American; and that the productivity of Canadian transport capital is much lower. This is a symptom of the heavy "burden of overhead capital" in Canada— in the

Table 6. 6

UNITED STATES AND CANADA: INDUSTRIAL DISTRIBUTION OF CAPITAL

	United States, 1939		Canada, 1950	
	Fixed capital	Capital-output ratio	Fixed capital	Capital-output ratio
I Agriculture	12.2%	1.35	10.8%	1.62
II Resource industries	16.5	2.09	15.2	3.94
III Primary manufacturing	5.9	.38	8.7	2.53
IV Secondary manufacturing	27.9	.55	18.1	1.69
V Transport, storage and communication	23.7	2.55	32.2	8.15
VI Trade, services and construction	13.8	.34	15.0	1.04
Total fixed capital	100.0%		100.0%	

Source: See text.

sense that much of this capital might be available for other uses if railways were not so extensive and so plentiful. The overwhelming importance of the transport, storage and communication sectors, and its decline, are shown in Chart 6. 1.

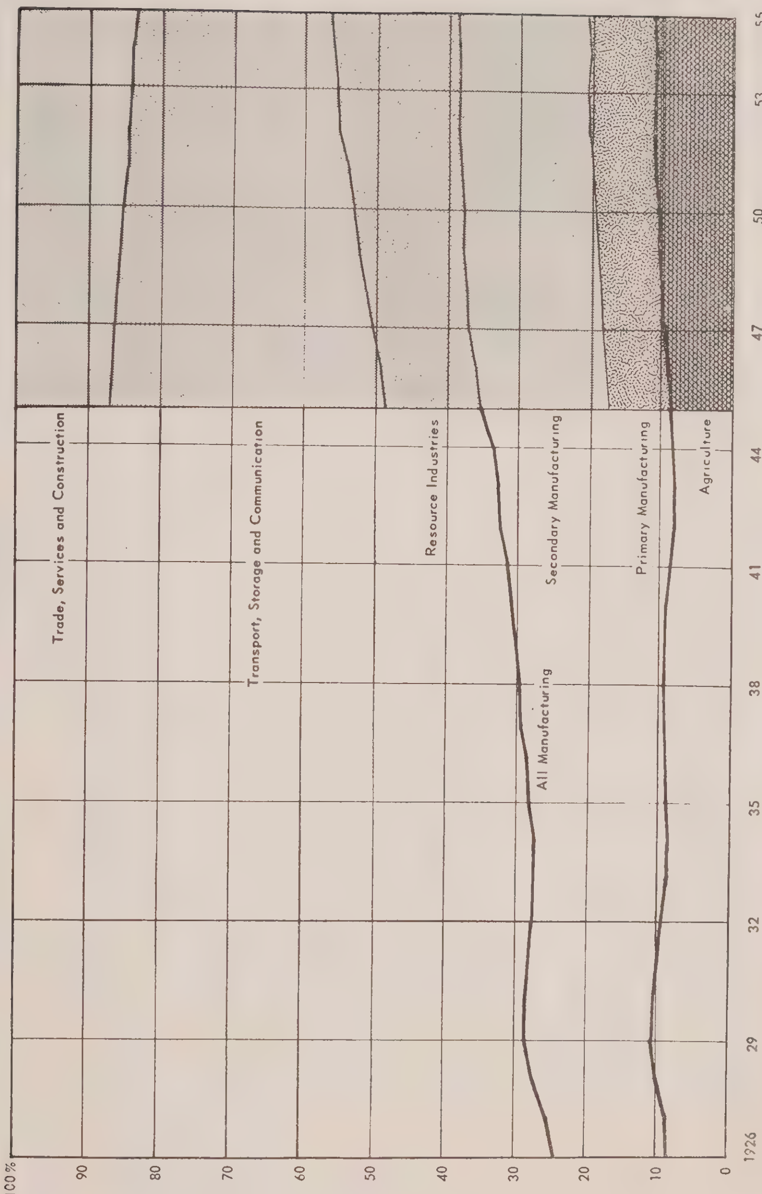
Obviously, a long-run shift in output from transport to manufacturing industries would greatly reduce the over-all ratio, if each industry's ratio remained unchanged. However, since capital in transport is fairly indivisible and durable, such a change would take many years to complete.

Although Canadian capital estimates by sector are not available except for the postwar period, we may use the data in Table 6. 7 to throw light on the question of whether such shifts have been responsible for the recent (slight) growth in the capital-output ratio for industry. This growth was concentrated in the early postwar period, though from 1953 to 1955 there was again some observable growth. Table 6. 7 shows the sectoral distribution of capital and output in 1946 and in 1955. The ratios for each sector have changed somewhat, and those for total industry have grown from 2.21 to 2.48. Was this growth due to growing ratios *within* the "average" sector, or to a shift of output from sectors with low ratios to sectors with higher ratios?

The shift seems to have been relatively unimportant. In the period the relative importance of agricultural output declined, and that of resource industries increased; and the resource industries have appreciably higher ratios than has agriculture (columns 4 and 10). Hence, one would expect the over-all ratio to rise, but the rise for this reason would be small because agriculture is a small part of the economy.

Chart 6:1

PERCENTAGE DISTRIBUTION OF GROSS STOCK OF INDUSTRIAL CAPITAL
BY SECTOR 1926–1955



Source: Total Gross Stock, 1926–1954 8002; 1945–1955 8000
Sector Totals 1926–1955 100–6000
Manufacturing Total 1945 carried back on 4400

Table 6. 7

EFFECT OF SHIFTS IN THE IMPORTANCE OF SECTORAL OUTPUTS ON THE INDUSTRIAL CAPITAL-OUTPUT RATIO

	1946						1955						Shift Calculations	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Gross stock		G.D.P.		Capital-output ratio		Gross stock		G.D.P.		Capital-output ratio		1955 ratio weighted by 1946 G.D.P. %	1946 ratio weighted by 1955 G.D.P. %
	$ KM	% of Total	$ KM	% of Total	$ KM	Weighted by 4	$ KM	% of Total	$ KM	% of Total	$ KM	Weighted by 10		
I. Agriculture	2,336	9.3	1,970	17.4	1.19	20.71	4,553	11.1	2,342	14.3	1.94	27.74	33.76	17.02
II. Resource industries	3,337	13.3	923	8.1	3.62	29.32	7,259	17.8	1,819	11.1	3.99	44.29	32.32	40.18
III. and IV. Manufacturing	6,787	27.0	3,710	32.7	1.83	59.84	11,042	27.0	5,275	32.1	2.09	67.09	68.34	58.74
V. Transport, storage and communication	9,387	37.4	1,093	9.6	8.59	82.46	11,136	27.3	1,486	9.0	7.49	67.41	71.90	77.31
VI. Trade, services and construction	3,257	13.0	3,646	32.2	.89	28.66	6,849	16.8	5,512	33.5	1.24	41.54	39.93	29.82
Total	25,104	100.0	11,340	100.0	2.214	—	40,840	100.0	16,434	100.0	2.48	—	—	—
Total weighted capital-output ratios	—	—	—	—	—	2.210	—	—	—	—	—	2.48	2.46	2.23

NOTE: $ KM=millions of constant (1949) dollars.

In columns 13 and 14 we attempt to calculate the importance of the net shift of G.D.P. among sectors. Column 13 shows that if each sector had its 1955 capital-output ratio, but its relative importance was that of 1946, the hypothetical over-all ratio would be 2.46 instead of the actual 2.48. That is, on this calculation only .02 of the .25 actual increase of the ratio from 2.21 to 2.46 (or about 8% of the increase) would be accounted for by shift.

If we look instead at column 14 we see the hypothetical value the 1946 over-all ratio woud have if sectors had their 1955 output weights. This hypothetical figure is, once again, .02 greater than the actual 1946 ratio, so that we may again state that .02 of the .25 actual increase is accounted for by inter-sectoral shifts, or 8%.

We may conclude that most of the actual increase since 1946 is due to *intra*-sectoral growth of capital-output ratios, not to inter-sectoral shifts. Indeed, in the long run we may expect the eventual decline in the relative importance of the high-ratio railways in Canada to result in a fall in the industrial ratio. (The reader will find the subject of shifts from construction and plant to machinery and equipment discussed in the next section.)

There is considerable belief among economists that industrial growth implies, for relatively mature western countries at any rate, a gradual change in the industrial distribution from dependence on agricultural and primary industries toward a rising preponderance of service and tertiary industries. This belief is based upon a statistical examination of change and development in many countries, carried out in the first instance by Colin Clark. If we accept this generalization for the sake of argument, we may ask what effect it may be expected to have on the country-wide capital-output ratio. To the extent that the tertiary sector is composed of personal service, retailing and finance industries, the level of the capital-output ratio in it is much lower than that in resource industries, and probably lower than that in agriculture. But these statistical generalizations to which we are referring also include transportation in tertiary industry. Transportation, insofar as it represents shipping and railroads, has a very high ratio. Even when road and air transportation are included, the ratio is still higher than that for the economy as a whole, as long as the publicly owned capital (roads, bridges, airports, etc.) is included in the figure. Hence, the generalization that there is a swing to tertiary industry does not necessarily imply a decline in the capital-output ratio, unless it is specified that the output and labour of the economy shift into the personal services, finance and trade sectors which have relatively low capital-output ratios.

The *fourth* force working on the capital-output ratio may be described as a change in the relative availability of labour and capital.

This subject is a large one, and some aspects of it have been covered in Chapters 2 and 3 of this study.

If we start with the supply of capital, we must look first at the amount of of saving which takes place annually out of the G.N.P. An increase in saving, however, need not directly affect the amount of fixed capital, because

(a) the savings may (as in the United Kingdom in the nineteenth century) be exported to countries more attractive for investment;

(b) the increase in the supply of saving may be offset by a reduction in the durability of capital goods (that is, it may be required to counterbalance an increased rate of depreciation or obsolescence);

(c) in any case, in the short run an increase in saving may not be taken up by investors, with the result that there is over-saving or under-consumption in the economy, so that the national output declines and unemployment increases. Whether this happens or not depends in large part on the profitability of new capital goods and on the rate of interest which must be paid for the use of savings;

(d) if the profitability of capital goods is high, the investment in capital may exceed national savings, since businessmen may find it convenient to import savings from abroad.

The above considerations relate to the availability of savings. It will be seen that a great deal depends upon the profitability (or expected profitability) of new investment. This profitability is the outcome, not only of the productivity of new capital, but also the sharing of that product as between wages and capital. Once again, we are brought to the importance of the question of the share of wages in the national income.

Over the long run we may say that the amount of capital installed by businessmen depends upon the choice of productive techniques that has been opened to them, and upon the relative prices of labour and capital. Over the long run the more expensive labour is the greater will be the temptation to adopt methods which depend heavily upon capital goods, since this will tend to reduce the total cost of producing a certain flow of goods. Furthermore, those industries which are most successful in reducing their costs will be able to offer goods at lower prices (or to resist an economy-wide increase in the price level) and so attract customers.

Hence, as the price of labour rises we will observe two interrelated effects:

(a) businessmen will tend to substitute capital for labour,

(b) there will be a tendency for industries using capital to expand faster than those which are more dependent upon the use of labour.

For example, in the economy as a whole we observe a switch from the laundry industry to the manufacture of washing machines. Furthermore, within the laundry industry there is a switch from hand to machine work.

The above considerations are all related to the supply of capital. If the supply of savings is very large and there is little institutional resistance to its utilization, the capital-output ratio might be expected to increase. For this to happen, however, it would be necessary for the "productivity" of the new capital goods to decline, either because they were being put to new uses less urgent than the uses of their predecessors, or because they were coming up against diminishing returns in the exploitation of land, natural resources or a limited market. In other words, the increase in the supply of capital relative to that of labour is likely to have an influence on increasing the capital-output ratio, but it is only a helpful condition—it is neither necessary or sufficient. What is more important is the productivity of the new capital goods relative to those which are already in place.

The *fifth* force at work may be called technical change.

Technical change is not distinct from the four forces which have already been covered; indeed, no one of the five points listed here is independent, but is partly a result and partly a cause of changes in the others.

Two categories of technical change may be distinguished. First, there is a great variety of improvements, none of which is truly revolutionary, that are introduced fairly continuously and regularly. These changes result in reduction in costs of production or the introduction of new goods. Many of these changes are of an organizational nature and may not involve the installation of new capital goods but merely a redistribution of tasks among people or locations or industries. Some may result from an improvement in morale, some from time and motion studies and others from inventions of new machines and methods. Organizational changes are most likely to increase the productivity of all factors including capital, and hence to be reflected in lower capital-output ratios. But not all of the non-revolutionary change is effected without the introduction of new capital and it is therefore not possible to assert positively that the continuing stream of minor technical changes serves either to increase or reduce the capital-output ratio.

In the second category of technical change we would place the so-called massive strategic or innovational change of the kind made familiar by the work of Schumpeter and Usher. These technical changes were referred to in Chapters 2 and 3. It may be useful however, to suggest one line of thought about such large innovations: the phases through which productivity may pass following innovation.

Almost all large and pervasive innovations involve installation of a huge volume of new capital goods. Some of these capital goods may replace older

types made obsolete; others, however, will be installed in what are, in fact, entirely new industries. To the extent that the latter type of installation takes place, it is unlikely that the new capital goods will immediately reach their expected efficiency. There will be a period of investigating their technical aspects which coincides with a period in which the demand for the new output is stimulated and developed. During this period we would expect the capital-output ratio to be higher than that existing before innovation, and probably higher than that which will eventually rule in the new industry.

As time passes, the increase in sales and the increase in technical knowledge about the innovation will contribute to both economies of scale and greater efficiency. Now there will probably be observed a diminishing capital-output ratio in the new industry.

However, if the innovation is really of the strategic or country-wide nature that the introduction of steel, electricity and gasoline engine were, it will be adopted by industries where it may replace high cost labour and thus reduce costs per unit of output, but where it does not bring about the low capital-output ratio achieved in the industry originally applying the new invention. It may be, for example, that the introduction of the diesel engine to transportation had a much greater effect on the capital-output ratio of transportation than did the application of the diesel engine to the textile industry, where it was merely replacing an already efficient source of power.

In summary, then, it is probable that these massive inventions first of all increase the capital-output ratio and then bring about its reduction as their efficiency is harvested. In a third phase, however, we may witness the application of the invention to less exciting situations where the capital-output ratio is actually increased.

With respect to both categories of technical change we may raise the question whether changes appear fortuitously, on the whole, or whether the character of the change reflects relative shortages in the economy. To put the matter another way: Is it to be expected that a relative shortage of labour in a given period will lead to the exercise of originality in developing techniques that economize on labour? Will the character of inventions reflect the structure of prices? We assert that we should be surprised if it could be convincingly demonstrated that relative shortages or the structure of prices do not exert an important influence on the character of innovation, but we cannot argue the matter here.

The effects on the capital-output ratio of five forces at work in the economy have been discussed in the preceding paragraphs:

(1) increasing scarcity of natural resources,

(2) economies of scale,

(3) shifts in the structure of industry,

(4) changes in factor proportions, and

(5) technical change.

While the impact of any one of these is likely to be significant, we have seen that they work in offsetting directions. In a short-run analysis, we could dismiss several of them as of minor importance, but in the long run any of them is likely to dominate the situation. In the absence of quantitative tools for appraising the importance of each, we can only suggest that the observed stability of the ratio may be the consequence of offsetting forces cancelling each other out over time. There are, however, data available on a sixth force, the apparent substitution of machinery and equipment for structures. We turn to this subject in the next section.

2. *The Relative Importance of Machinery and Equipment*

In Part I we saw that part of the observed change in the capital-output ratio over time may be accounted for by the change in the industrial distribution of labour and output within the economy. The growth of industries which have a low capital-output ratio relative to the rest of the industries of the economy is likely to lead to a lowering of the over-all ratio.

This would not necessarily be the case in a closed (no foreign trade) economy. If there were no possibility of exporting or importing savings, the capital-output ratio for the economy would be fairly heavily dominated by the domestic savings ratio and by the rate of growth of output. The growth of demand for the products of industries that have a low ratio would be counterbalanced by the cheapening of investment goods and a reduction in the cost of finance, so that the whole economy (including the industry which is growing) would tend to intensify its use of capital. However, when the possibility of investment abroad exists, the growth of industries which have a low capital-output ratio may well lead to an increase in the incentive to place savings abroad rather than force them into domestic use. Conversely, the rise in industries with a high capital-output ratio (such as the railroads in Canada at the turn of the century) will mean a probable rise in the over-all ratio for the economy. If there were no possibility of importing capital from abroad, however, the rise in the railway industry would have to be counterbalanced by a decline in the ratio for the other industries in the economy.

The foregoing analysis of the importance of industries, however, depends upon an implicit assumption that the rate of depreciation or the average service life is the same for fixed capital in all parts of the economy. That is, the analysis above would be valid only if capital goods in the railway industry had the same service life as capital goods in manufacturing, farming

and the service industries. If this assumption were correct, a given amount of savings would build up the same amount of capital, regardless of the industry to which the savings were diverted. However, if the service life of the assets used by various industries is different, then a dollar's worth of savings put to the service industry may merely serve to replace the discards from the stock of short-lived assets owned by that industry. On the other hand a dollar's worth of savings used by the railroad industry may be used to build up the stock of highly durable construction goods owned by that industry, the rate of discard from which is slower than the rate from the service industry stock.

In earlier sections we discussed the assumptions made about the length of life of assets owned by various industries. While there is a wide spectrum of assumed service lives, it is not continuous from zero to 100 years. Rather, it centres around an average life of about 15 years for machinery and equipment, and about 42 years for structures. This is one very important way in which this distinction between types of new investment does affect the overall capital-output ratio. There are other ways also, and we shall examine them in the following pages. First, however, we turn to a statistical examination of the importance of machinery and equipment compared with that of construction.

Let us first examine the American data. In 1900 the expenditure by business on plant was approximately equal to that spent on equipment. The proportion of expenditure on plant, however, has declined through the years, while that of equipment has retained its proportion of the privately produced G.N.P. By 1955 business was spending almost 70% *more* on equipment than it was on plant.[13]

The same source contains estimates of the gross stocks of privately owned plant and equipment. In 1910 the stock of such plant was approximately twice that of equipment. This relationship continued until 1929, but since that period there has been a very decisive decline in the relative position of plant to equipment. By 1950 the stock of plant was very little higher than it had been in 1930, whereas the stock of equipment has increased until it was 75% more than its 1930 level. The figures for 1955 or 1956 will likely show that the two stocks have the same size. We find similar evidence in the 1954 "National Income Supplement" to the *Survey of Current Business* of the U.S. Department of Commerce. Gross private domestic investment (in 1947 dollars) in producers' durable equipment was 8.5 billion, and new plant was 9.3 billion, in 1929. In other words, investment in plant was some 10% greater than that in machinery and equipment. In the 1950's, however, the relationship had been reversed, and producers' durable equipment was in the average year almost twice as heavy an expenditure as business plant. The same pattern may be observed in current dollar figures.

[13]These estimates are taken from the Machinery and Allied Products Institute's *Capital Goods Review* for May, 1955.

Similar evidence, finally, is to be derived from Raymond Goldsmith, whose national wealth estimates yield very complete data for the comparison of equipment and plant stocks. Data for selected years are shown in Table 6. 8. It will be seen that the dominance of structures yielded very slowly over the 50 years prior to 1946, but that by 1949, nearly half the stock was in the form of machinery and equipment.

Table 6. 8

UNITED STATES INDUSTRIAL NET FIXED CAPITAL STOCK SELECTED YEARS, 1896-1949

(millions of 1929 dollars and percentage)

	(1) Structures		(2) Producers' durables		(3) Total industrial fixed capital	
	1	2	3	4	5	6
1896	26,985	70	11,707	30	38,692	100
1899	30,822	71	12,743	29	43,565	100
1904	38,742	69	17,130	31	55,872	100
1909	46,256	68	22,178	32	68,434	100
1914	53,063	67	26,317	33	79,380	100
1919	57,716	65	31,596	35	89,312	100
1924	63,079	65	33,665	35	96,744	100
1929	73,481	65	39,138	35	112,619	100
1934	69,249	68	32,543	32	101,792	100
1939	64,725	65	34,714	35	99,939	100
1944	60,517	60	40,604	40	101,121	100
1949	66,368	51	64,329	49	130,697	100

NOTES: Columns 1 and 2: Non-residential non-farm, *plus* mining (underground) *plus* farm, structures. Columns 3 and 4: Producers' durable equipment.

SOURCE: R. W. Goldsmith, *A Study of Saving in the United States*, Vol. III, p. 20.

In the United Kingdom the preponderance of building and construction seems to be much less than that in the United States. Indeed, if we can accept the Phelps Brown estimates, the importance of buildings has long been *smaller* than that of equipment. The figures, however, are not finely divided, so that we have only two categories:

(a) revenue yielding buildings, including houses, and

(b) all other capital goods, including inventories.

In 1870 (a) and (b) were approximately equal. By 1880 (b) had become slightly larger, a tendency which continued until World War I. After the war the growth of the two series continued the relationship discovered before the war, and superiority of equipment and inventory stocks continued until 1938, when the series ended.[14]

For the period since 1938, we have the more refined data of Redfern. His calculations give the following results:

[14]E. H. Phelps Brown and B. Weber, "Accumulation, Productivity and Distribution in the British Economy 1870-1939", *Economic Journal*, June, 1953, pp. 286-287.

Table 6. 9

UNITED KINGDOM GROSS FIXED CAPITAL

(1948 prices)

Year	Plant, machinery and vehicles	Industrial and commercial buildings
1938	4,700	4,900
1947	4,800	4,900
1952	6,100	5,400

It will be seen that by Redfern's calculations the stock owned by industry was, even at the end of 1938, dominated by buildings, but that in the post-war period, plant, machinery and vehicles had become predominant. This trend is even more evident from Redfern's net fixed capital figures, where it is shown that the depreciation of the many old buildings in use in the United Kingdom has reduced the value of buildings greatly in recent years.[15]

Finally, in Canada the same trends are noticeable. Investment estimates, measured in 1949 dollars, suggest that in 1911 the expenditure by industry on construction was four times that of the expenditure on machinery and equipment. By the late 1920's, however, the figures in the two series were approximately equal, and in the 1950's the constant-dollar expenditure on machinery and equipment ranges from one-an-a-half to two times the expenditure on construction.

In 1926 the gross stock of industrial structures was almost three times that of the equipment gross stock, whereas by the 1950's the stock of machinery and equipment had increased to 80% of the construction stock. This increase is particularly impressive when the low rate of discard of construction goods is remembered.

The same data can be viewed in another way, with the help of the capital-output ratio. The ratio of total fixed capital to G.D.P. in the late 1920's was approximately 3.00. By 1953 this ratio had fallen to 2.35. This decline was the net outcome of a decrease of the construction-output ratio from 2.19 to 1.38 over the period, and an *increase* in the machinery and equipment-output ratio from .78 to .97.

The outcome of this statistical review is that we find that in the United States and Canada the ratio of plant stock to equipment has been changing continually in favour of equipment since the 1920's. This preponderance of plant seems to have been absent in the United Kingdom over the past 50 years, though the early data are difficult to interpret. If we can accept the United Kingdom as having relevance for the Canadian future, it would appear that the upward sweep of the equipment ratio relative to the structure ratio would be diminished, so that in the future both might grow at the same rate.

[15]Phillip Redfern, "Net Investment in Fixed Assets in the United Kingdom, 1938-53", *Journal of the Royal Statistical Society*, Vol. 18, 1955, p. 161.

Table 6. 10

MACHINERY AND EQUIPMENT-OUTPUT RATIOS

	United States		Canada
	U.S. Dept. of Commerce	Machinery & Allied Products Institute	
	(1)	(2)	(3)
1910	—	.57	—
1913	—	.60	—
1915	—	.66	—
1917	—	.61	—
1919	—	.72	—
1921	—	.80	—
1922	—	.72	—
1923	—	.67	—
1924	—	.69	—
1925	—	.67	—
1926	—	.65	.89
1927	—	.67	.82
1928	—	.69	.74
1929	.70	.66	.81
1930	.75	.78	.87
1931	.80	.83	1.01
1932	.95	.97	1.06
1933	1.00	1.00	1.16
1934	.90	.90	1.02
1935	.75	.80	.92
1936	.70	.72	.87
1937	.65	.68	.81
1938	.70	.73	.81
1939	.65	.69	.75
1940	.60	.63	.68
1941	.55	.57	.65
1942	.50	.54	.56
1943	.50	.51	.59
1944	.45	.48	.55
1945	.50	.50	.61
1946	.55	.55	.64
1947	.55	.58	.69
1948	.60	.60	.76
1949	.65	.68	.83
1950	.65	.67	.86
1951	.65	.68	.89
1952	.65	.69	.92
1953	.65	.71	.97
1954	—	.77	1.08
1955	—	.79	1.04

SOURCES: Col. 1: Inverse of ratio charted in "Survey of Current Business", December, 1954, p. 25, Chart 8.
Col. 2: Machinery and Allied Products Institute, *Capital Goods Review*, May, 1955, Chart 4.
Col. 3: Industrial machinery and equipment gross stock divided by industrial G.D.P. *at factor cost*.

Against this expectation must be set our particular knowledge of the Canadian situation which is, that the stock of structures has been greatly dominated by the railways. There is still some excess capacity on the majority of Canadian railway lines, so that the future growth of the economy will probably witness from this cause alone a continued diminution in the structures-output ratio, assuming the capacity is finally utilized. Table 6. 10

presents the ratio of machinery and equipment to output for Canada and the United States

3. *Depreciation*

Our new capital data also provide insight into some of the questions involved in the analysis of depreciation. In Part IV we discussed the theoretical interaction of the growth of investment, depreciation provision for replacement, and the price level. In the following paragraphs we shall introduce some data which should assist in the analysis of the growth of Canadian capital in a period of rising prices.

We first examine the price level of capital goods. In the earlier discussion we suggested that as the general price level rises, the ability of depreciation quotas to finance replacement declines. We attempt here to present a "price index of depreciation", the explanation of which must, for brevity, be in symbolic terms. The amount of depreciation in year n is, for any type of asset, equal to $\frac{1}{L} G_{n-1}$, where G is the gross stock and L is the life of the kind of asset. G is the cumulation for the previous L years of investment in this kind of asset. Hence depreciation is much affected by the prices at which assets were purchased.

The price level relevant to depreciation of an asset therefore is the average of the price levels of each year, where the price level of each year is given weight proportionate to the amount of investment that took place then. That is, using c for original cost of assets and k for their cost in constant dollars.

$$\text{"Depreciation price index"} = \frac{\frac{1}{L} G^{c}_{n-1}}{\frac{1}{L} G^{k}_{n-1}} = \frac{\sum_{n=1}^{n=L} I^{c}_{n}}{\sum_{n=1}^{n=L} I^{k}_{n}} .$$

Clearly, the greater the investment of any particular year, in relation to the investment of other years within the period of L years, the greater the effect of that year's price level on the index above. If the prices of capital goods are gradually increasing, the effect of their price level in past years is to keep the depreciation price index always below that of the current year; similarly, if prices are falling, the depreciation price index is always above that of the current year.

Table 6. 11 shows values of this index for industry since 1926. As the above definitions suggest, it is actually the ratio between the values of the gross stocks, which is the same as the ratio of the depreciations one year later.

Table 6. 11

"PRICE INDEX" FOR GROSS STOCKS AND DEPRECIATION,[a] 1926-55

	Total gross stock at original cost (1)	Total gross stock at 1949 prices (2)	"Price index" (ratio 2/1) (3)
1926	10,129.0	22,224.2	.456
1927	10,465.3	22,395.9	.467
1928	10,933.5	22,767.0	.480
1929	11,639.3	23,536.5	.495
1930	12,227.3	24,256.2	.504
1931	12,472.9	24,514.3	.509
1932	12,379.7	24,351.1	.509
1933	12,199.8	24,063.1	.507
1934	12,063.3	23,815.5	.507
1935	11,890.5	23,639.4	.503
1936	11,834.3	23,424.4	.505
1937	12,042.4	23,721.0	.508
1938	12,132.6	23,899.7	.508
1939	12,229.3	24,060.8	.508
1940	12,486.5	24,359.2	.513
1941	12,925.7	24,830.5	.521
1942	13,318.7	25,089.6	.531
1943	13,520.2	24,936.8	.542
1944	13,709.1	24,831.4	.552
1945	13,996.9	24,888.8	.562
1946	14,621.3	25,309.1	.578
1947	15,886.3	26,374.7	.602
1948	17,597.1	27,765.3	.634
1949	19,402.7	29,045.0	.668
1950	21,330.6	30,317.4	.704
1951	23,796.9	31,669.3	.751
1952	26,654.5	33,206.8	.803
1953	29,719.0	34,902.3	.851
1954	32,551.6	36,498.2	.892
1955	35,394.8	38,040.2	.930

a The price index for depreciation is one year earlier than that shown here, since depreciation on our assumption is $I/L\ G_{n-1}$. For 1927, then, use the figure for 1926.

SOURCE: Appendix B, Table 6B. 7.

It will be observed that this index is well below—or actually, well behind—the price indexes for capital goods shown in Table 6. 2. It would take many years of price stability in the future for the current investment and stock indexes to be identical.

Similar indexes can be compiled from the same data for machinery only or for construction only. Furthermore, similar indexes could be constructed from the "net stock" columns of the same tables. Such net stock indexes would be useful in deflating the census value of assets for the same industry or coverage, since such enumerations are usually of "depreciated wealth". (However, the enthusiast is warned that most census enumerations of wealth contain land and other unspecified assets which cannot properly be deflated by a fixed asset index.)

Hence, the more or less automatic saving which businesses undertake as provision for depreciation is likely to be inadequate for replacement needs during a period of rapidly rising prices unless new investment is also rising very rapidly or unless, of course, tax depreciation provisions are increased. We may turn our attention to the latter subject: the depreciation provisions which business actually makes each year.

Our chief source of information on actual assignment of corporate revenue to depreciation reserve is the National Accounts; this source, in turn, is based upon national revenue corporate income tax returns. We shall show that, although the levels differ, the rise and fall of our depreciation estimates has paralleled that shown in the National Accounts, when measured as a percentage of new investment.

The levels differ for a variety of reasons; among these is the inclusion in the National Accounts' depreciation estimate of bad debt losses and similar business costs which are in effect losses of capital by business, institutional and residential depreciation; and, of course, quick write-off systems of income tax as an incentive for capital formation in certain defence and essential industries. All these are omitted from our estimates of depreciation by industry. Thus, the ratio of our depreciation figures to those published in the *National Accounts* (a ratio which is used in our forecasts: see Table 6. 15) is interesting and important for forecasting, but not particularly helpful for appraising the characteristics of either of the two statistical series.

Table 6. 12 suggests a better way of analyzing the record of depreciation. It is often suggested, in the absence of other information, that depreciation is a certain constant proportion of investment, or of Gross National Expenditure. Such assumptions are frequently given specific form when statisticians are making estimates of new net investment or net national product. Since, as we have seen, there is over the long run some constancy in the ratio of gross stock to national output, and since depreciation is probably proportional to gross stock (apart from shifts in the composition of the stock), the latter suggestion is probably better. But the former, that depreciation can be estimated from investment, is true only if investment is running at a constant ratio to output and capital, which is very unlikely at any given time.

In Table 6. 12 we show the ratio of non-residential depreciation, a part of the total depreciation figure published in the National Accounts, to new investment in non-residential construction and in machinery and equipment. It will be seen that there is great instability in the ratio over the whole period, but that it is higher in depressions than in booms, as would be expected from the behaviour of the capital-output ratio.

In the remaining columns we show the ratio of depreciation to new investment in our own calculations for industrial capital. These are shown

Table 6. 12

THE RELATION OF DEPRECIATION TO INVESTMENT

	National Accounts: Ratio of non-residential depreciation to non-residential investment	This Study: Ratios of depreciation to new investment					
		Construction		Mach. and equip.		Total	
		\$CM[a]	\$KM[b]	\$CM[a]	\$KM[b]	\$CM[a]	\$KM[b]
1926......	91	62.4	103.5	106.0	102.0	85.6	102.7
1927......	89	52.1	81.7	85.7	77.6	70.0	79.5
1928......	70	38.9	61.5	75.7	66.2	56.7	63.8
1929......	64	34.7	55.2	65.6	56.9	49.6	56.0
1930......	77	48.6	71.2	87.0	71.3	67.4	71.3
1931......	109	75.3	98.7	164.5	129.5	114.5	112.1
1932......	203	171.5	211.1	301.3	238.5	234.6	224.0
1933......	279	259.6	312.6	373.3	299.0	319.0	305.7
1934......	199	225.9	263.6	251.7	205.2	240.6	231.8
1935......	162	174.1	208.3	189.6	161.4	182.8	182.7
1936......	133	139.7	168.1	143.1	129.1	141.6	146.9
1937......	100	112.0	143.9	87.9	86.8	97.4	109.6
1938......	107	128.3	158.7	90.8	90.0	104.7	116.4
1939......	120	137.2	167.1	97.8	98.1	112.8	125.4
1940......	99	115.9	145.9	61.1	66.5	78.5	93.3
1941......	88	88.2	117.8	49.5	57.7	62.2	78.7
1942......	104	73.3	110.0	54.2	64.2	61.5	81.6
1943......	129	95.9	176.9	63.4	77.3	74.8	108.3
1944......	131	128.0	187.5	51.4	60.4	70.3	92.1
1945......	111	99.8	138.3	56.7	63.7	70.2	87.6
1946......	75	57.2	83.1	52.2	58.2	54.3	68.5
1947......	60	43.3	68.6	32.5	40.1	36.3	50.2
1948......	54	33.4	57.7	31.9	42.5	32.5	48.3
1949......	56	32.4	55.7	35.4	47.6	34.2	50.7
1950......	59	30.3	52.0	39.8	54.1	36.0	53.2
1951......	55	25.5	47.4	35.7	51.8	31.6	50.0
1952......	53	21.3	41.6	38.4	52.3	30.8	47.9
1953......	56	22.4	40.5	40.7	53.7	32.8	48.3
1954......	62	25.4	42.0	52.4	66.2	40.2	55.7
1955......		26.0	42.7	57.3	70.0	42.8	58.1

a Millions of current dollars.
b Millions of constant (1949) dollars.

SOURCES: *National Accounts:* Depreciation from National Income Section, D.B.S. New Investment from *National Accounts, 1926-50 and 1950-55,* Table 2, as adjusted for 1926-32.
This Study: Depreciation and new investment at original cost and at constant prices from 8002 B and 8002 A. See Appendix B.

both in original cost (\$CM) and constant (1949) price (\$KM) terms. Since depreciation price indexes lag behind current prices, we would expect the earlier price levels to keep original-cost depreciation lagging behind new expenditure, and this is confirmed here in the total and construction columns: the \$CM ratio is presently below the \$KM ratio.

This ultimate tendency is also visible in the machinery series. However, the shorter life of new machinery and the price and volume declines in the interwar period mean that for some periods the ratio of original-cost depreciation to new current-cost investment is *greater* than if both were stated in constant dollars. In other words, as prices are going down, the business-

man purchasing machinery is taking depreciation allowances based on the higher prices of a few years ago; but if his depreciation—as in the case of structures—were based on the prices of many years back, he would still find that (even in the serious fall of real investment in the '30's) his actual depreciation ratio was well below that of the constant-dollar ratio.

Thus, even abstracting from the instability of National Accounts' depreciation arising from changing tax regulations, it is unlikely that depreciation will be a constant proportion of new investment as long as the rate of price changes is unstable: only if price and volume changes were gradual and steady, would there be a simple relationship between them.

VI. *Forecast*

We have already outlined, in Part III, the method by which our historical record of the industrial capital stock has been derived. Greater detail, we would remind the reader, is to be found in the appendices. We have also suggested briefly the method used to forecast investment in Canada.

We should first make clear what expenditures we are classifying as investment. The best known concept of investment for Canada is that given in the National Accounts where it is divided into the following four categories:

1) New residential construction

2) New non-residential construction

3) New machinery and equipment

4) Changes in inventories

Of these four categories, it is our present intention to forecast only 2) new non-residential construction and 3) new machinery and equipment. We are faced with a classificatory difficulty in that this chapter is devoted to *industrial* development, whereas the two National Accounts' categories isolated above are not designed to refer exactly to industry.

However, although there are small adjustments to be made, the two National Accounts categories and the concept of investment by industry are statistically very similar. In the first place, they both obtain their basic information from *Private and Public Investment in Canada (PPI)* and the *Investment Outlook*. In the second place there is very little scope in the National Accounts' categories of non-residential construction and machinery and equipment for investment which is not undertaken by industry. The marginal categories which may or may not be included are, roughly speaking, housing investments undertaken by industry or government and rented for a profit and investment by institutions such as hospitals, schools, churches and universities.

The difference between our classification and that of the National Accounts can most easily be demonstrated with figures, and this is done below. However, we may attempt to suggest in words the inclusions and exclusions.

The National Accounts' categories start from the total of private and public investment in Canada for a given year, and deduct from it certain items. Our own definitions begin by building up industry totals. The question is what sub-groups have we omitted which are still in public and private investment.

The National Accounts construction and machinery and equipment items are derived by deducting from the total private and public investment expenditure in *PPI:*

1) Investment by all federal, provincial and municipal government departments (classified to government expenditure on goods and services).
2) Government housing (also classified to government expenditure on goods and services).
3) New residential construction other than by government (classified to new residential construction).
4) United States government expenditure on wartime "Canol" project (not shown in National Accounts).
5) Investment in inventories (shown as change in inventories).[16]

   The only area about which doubt might arise as to classification is the interpretation of the general category of government. The category of government in the National Accounts does not include municipal hospitals, churches, universities, nor government-owned business enterprises.

Our concept of industry is, so far, compatible with the National Accounts' inclusion of government-owned business enterprise in industry rather than in government. However, the institutions, such as municipal hospitals, churches and universities, are defined by us as social capital, not industrial capital, and therefore investment by these institutions is excluded from our definition of industrial investment. Hence we would expect that in any year our total investment, by industry would be less than the total of non-residential construction and machinery and equipment, as shown in the National Accounts, by the amount of investment by such institutions as municipal hospitals, churches and universities.

In recent years we can derive our total directly by turning to the annual *Investment Outlook* publication. In Table 6, the total of business enterprise

[16]This information is all obtainable from the D.B.S. publication *National Accounts Income and Expenditure, 1926-1950,* in footnotes and in the appendix, p. 110.

and government-owned enterprise is the same as industry by our classification, since this excludes investment for institutions, housing and government.

It will be seen then that if to the forecasts made here for industrial investment are added the social capital forecasts of institutional and residential investment and a forecast of inventory investment, the total will be equivalent to Gross Domestic Investment, as defined by the National Accounts.

Such reconciliation, though necessary, is wearisome. The reader will find in Appendix A of this chapter a further discussion of the differences between our series and already published data. We turn now to the next step in making the forecast of industrial investment.

The method we follow requires a decision by the forecaster as to the future course of the capital-output ratio for industry. The ratio has as its numerator the gross stock held by industry (calculated by our cumulation method) and as its denominator the Gross Domestic Product (G.D.P.) at factor cost of industry. It can also be considered as the sum of the construction-output ratio and the ratio of machinery-and-equipment to output.

Table 6. 13 shows the recent values of this ratio for industry for Canada. The data are also shown in Chart 6. 2 (manufacturing) and Chart 6. 3 (industry). The latter has a logarithmic vertical scale.

It will be seen that the over-all fixed-capital ratio (columns 5 and 6) has been declining since the 1920's. There were interruptions in the war, when capital was used intensively so that the ratio fell, and in the depression, when much capital was underemployed, so that the ratio rose. Further discussion of the aggregate ratio is less valuable than discussion of its separate parts, so we shall now consider the two ratios separately.

From a value of over 2.25 in 1926, the structures ratio has fallen to almost 1.25 in 1955. This decline is also observable in other countries, particularly the United States, as has been remarked in this study in Chapter 2 and in earlier sections of this chapter. There are at least three reasons for the decline:

(a) The increasing output of the service industries as a proportion of total output has meant that an increasing part of the national product is originating in capital-sparing industries. This increase in trade and service output as a proportion of total output is, however, much more an American phenomenon than Canadian (see Chapter 2), and cannot be an important factor here. Chart 6. 4 shows the low capital-output ratio of trades, services and construction.

(b) The large stock of capital in private transportation industries, especially the railways, is now being used more intensively, presumably because of the growing transportation requirements of

a growing economy. The chart shows the *declining* capital-output ratio for structures of the transportation sector. To this decline must be linked the slightly declining importance of the transport sector, a sector which has a very high (though declining) ratio.

Table 6. 13

INDUSTRY: CAPITAL-OUTPUT RATIOS GROSS STOCK/G.D.P. AT FACTOR COST

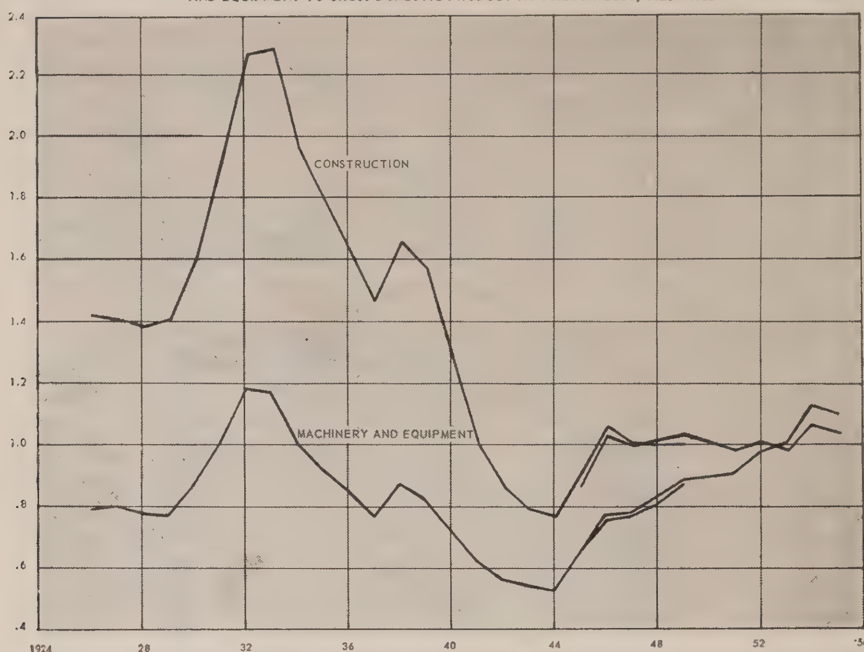
(1949 dollars)

	Construction		Machinery and equipment		Total	
	(8002)	(8000)	(8002)	(8000)	(8002)	(8000)
	(1)	(2)	(3)	(4)	(5)	(6)
1926..........	2.280	—	.889	—	3.169	—
1927..........	2.164	—	.817	—	2.981	—
1928..........	2.048	—	.743	—	2.791	—
1929..........	2.225	—	.812	—	3.037	—
1930..........	2.328	—	.874	—	3.202	—
1931..........	2.696	—	1.009	—	3.705	—
1932..........	2.872	—	1.055	—	3.927	—
1933..........	3.221	—	1.156	—	4.377	—
1934..........	2.901	—	1.017	—	3.918	—
1935..........	2.698	—	.925	—	3.623	—
1936..........	2.561	—	.867	—	3.428	—
1937..........	2.378	—	.811	—	3.189	—
1938..........	2.396	—	.810	—	3.206	—
1939..........	2.233	—	.749	—	2.982	—
1940..........	1.991	—	.684	—	2.675	—
1941..........	1.820	—	.650	—	2.470	—
1942..........	1.539	—	.558	—	2.097	—
1943..........	1.588	—	.576	—	2.164	—
1944..........	1.494	—	.548	—	2.042	—
1945..........	1.633	1.495	.610	.691	2.243	2.186
1946..........	1.596	1.501	.635	.713	2.231	2.214
1947..........	1.522	1.469	.689	.748	2.211	2.217
1948..........	1.489	1.466	.757	.800	2.246	2.266
1949..........	1.475	1.489	.830	.862	2.305	2.351
1950..........	1.402	1.449	.857	.880	2.259	2.329
1951..........	1.330	1.417	.886	.898	2.216	2.315
1952..........	1.289	1.408	.919	.931	2.208	2.339
1953..........	1.269	1.414	.966	.982	2.235	2.396
1954..........	1.357	1.535	1.083	1.094	2.440	2.629
1955..........	1.272	1.450	1.043	1.053	2.315	2.503
1960..........	—	(1.418)	—	(1.114)	—	(2.532)
1965..........	—	(1.399)	—	(1.186)	—	(2.585)
1970..........	—	(1.381)	—	(1.257)	—	(2.638)
1975..........	—	(1.363)	—	(1.329)	—	(2.692)
1980..........	—	(1.341)	—	(1.400)	—	(2.741)

SOURCES: 8000: Appendix B, Table 6B. 2.
8002: Appendix B, Table 6B. 9.
Forecast ratios: see text.

TOTAL MANUFACTURING: RATIO OF GROSS STOCK OF CONSTRUCTION AND OF MACHINERY AND EQUIPMENT TO GROSS DOMESTIC PRODUCT AT FACTOR COST, 1926 – 1955

Chart 6:2



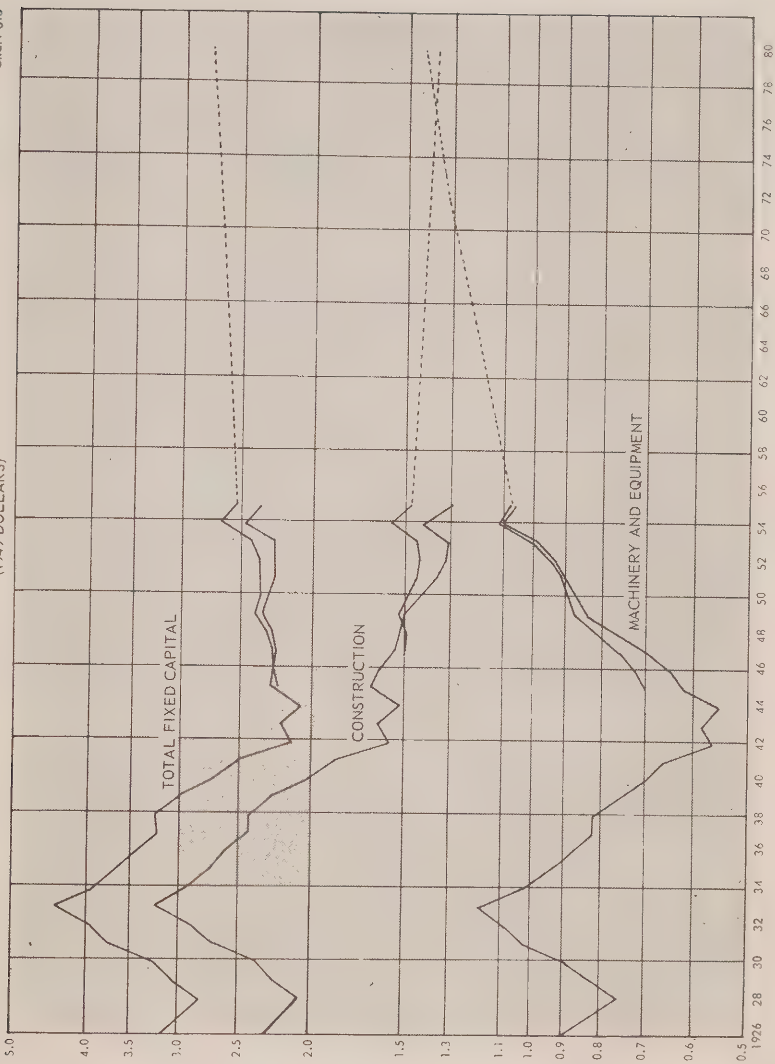
Sources: Gross Stock 1926-1949: 4,400
1945-1955: 3,000 plus 4,000
Gross Domestic Product: Chapter 5

(c) There is also some evidence that manufacturing and trades, services and construction, are literally economizing on construction goods—they are able to obtain more output per dollar of plant than was the case 30 years ago. This is partly a reflection of the construction industry's ability to build cheaper and more efficient plants, but largely of the ability of the using industries to utilize a very simple building as shelter for a great deal of activity.

Our forecast, which is shown in parentheses in the lower lines of Table 6. 13, continues at a reduced rate the long-run decline of the construction ratio. We believe that the forecasts in other parts of this study imply a great deal of construction in the resource industries—especially power production—and possibly in transport facilities to serve them. We observe that in the past, periods of exploration and discovery have meant abandoning capital goods before their technical life is up, and it is not unlikely—on the basis of the energy studies, the materials studies and the exports studies (made for the Commission)—that we are about to enter upon a prolonged period of construction expenditure connected with exploration and exploitation. Therefore, while it is fairly certain that the manufacturing sectors of the economy will continue their long-run tendency to reduce the construction capital-output ratio, the resource sectors may offset part of the decline.

Chart 6:3

CAPITAL OUTPUT RATIO : GROSS STOCK ÷ G.D.P.
TOTAL INDUSTRY, 1926 – 80
(1949 DOLLARS)



Source: Table 6. B

The reader will observe that the table provides two ratios for the period 1945-55. The ratio numbered 8000 is the ratio of the total of our individual cumulations to the industrial G.D.P.; while the ratio numbered 8002 is the ratio for an aggregatively calculated gross stock for all industry. In 1950 the construction ratios are about equal, but in later years the former is greater. Since the same investment data were used in each calculation, the reason for the discrepancy arises from different deflation techniques, different discards from past years (very unlikely in this case), or—most likely—a shift in the distribution of capital among industries so that the average life implicit in the total of all capital is in this case growing (see Appendix B). This last possibility means that the distribution of industrial capital is shifting toward industries with a longer average life, so that the stock and the capital-output ratio are larger.

Since the 8000 calculation has been carried out in detail, the level of construction gross stock derived from it was judged to be more accurate than the level derived from the 8002 calculations. Consequently, the 8000 estimate for 1955 was the base from which the forecasts were made. The job was to discover what investment would be necessary to replace discarded capital goods and to contribute to the gross stock so as to keep the capital-output ratio at the forecast levels from 1955 to 1980.

The machinery and equipment stock-output ratio will be seen to have increased unmistakably since 1926, though insufficiently to keep the over-all capital-output ratio—including construction—from falling. By both the 8002 calculations and the 8000 total, the ratio grew after the war from less than .8 to about 1.05. (There is no serious problem here of discrepancy between the two methods of calculation.) This means that a dollar's worth of output is requiring more dollars' worth of machinery and equipment as time passes.

What is the reason for this trend upwards? To put it the other way, why is the "productivity" of one dollar's worth of machinery going down? There are, probably, three very general reasons, one of which is statistical in nature:

(a) We have already suggested that many new methods, while profitable, bring a saving in factor costs that is small in absolute terms. Both the productivity of labour and the ratio of capital to output are increased, or prevented from decreasing. Other inventions, that might have produced a reduction of the capital-output ratio, have been neutralized in this respect by falling hours of work, or other forms of under-utilization. Still other innovations have been introduced to counteract the employment of labour of reduced skill or training. Such changes tend to raise the capital-output ratio, especially of machinery.

(b) The statistical method may suggest an increase in the stock in the recent past, whereas discarding and replacement during the war may in fact

have been delayed; if this were so the recent apparent increase in capital stock of machinery may be *in part* illusory, and the ratio of capital to output may have been about constant since 1939. There is no doubt that our calculating assumption of constant service life of machinery in each industry gives a misleading sense of rise and fall in the stock, arising from attributing discarding and replacement to years when owners have decided to postpone replacement. But this explanation cannot cover more than part of the recent apparent increase in the stock of machinery and equipment relative to G.D.P.

(c) The observed fall in the ratio for construction, discussed earlier, may not indicate a fall in the use of all capital, but merely a switch from the use of structures to machines. There are several reasons why this substitution decision could gradually be made, in aggregate:

(i) The increasingly higher costs in construction—symptomatic of a slow rate of productivity increase in the construction industry—may give incentive for substitution whenever it is technically possible.

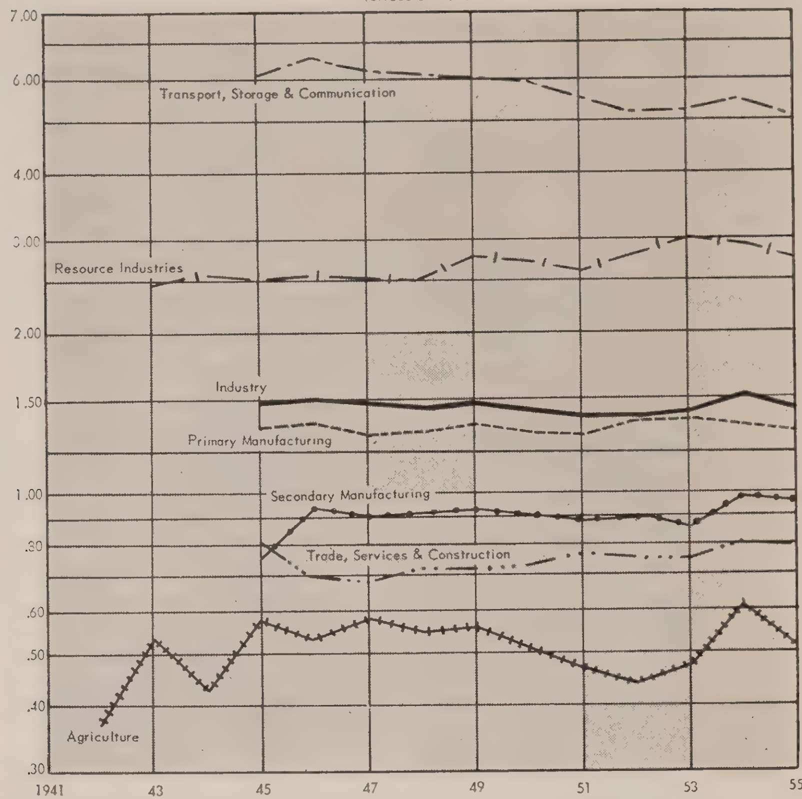
(ii) The use of buildings suggests storage and inventories which are themselves expensive to carry, and which business enterprise sets itself to reduce as an overhead. Overheads and inventories can be reduced by installing extra mechanical capacity which keeps large amounts of materials moving steadily without having to change jigs, dies or parts of multipurpose machines.

(iii) In a general way "equipment" may merely reflect a more manufactured or prefabricated way of doing what was originally done by a "structure": chutes in old buildings may be replaced by trucks, belts or assembly lines in new buildings; coaling stations on railways are in effect replaced by the use of diesel locomotives which make fewer stops; logging railroads are displaced by trucks and tractors; shelves, counters, drawers and bins in old shops are replaced by refrigerators, racks, freezers and cash registers in the modern market.

The last two of these reasons would not, of course, hold unless the first one—the increased price of structural items—were also true.

So far, we have presented three aspects of our forecast of the capital-output ratio. The first of these was that the construction ratio was declining, but that there were reasons connected with the probable growth of the resource industries and primary manufacturing for believing that it would not fall much farther and that it would level off in the near future. The second was that there is some evidence, depending upon our speculative over-all

CAPITAL OUTPUT RATIO – CONSTRUCTION (GROSS STOCK) CHART 6.4

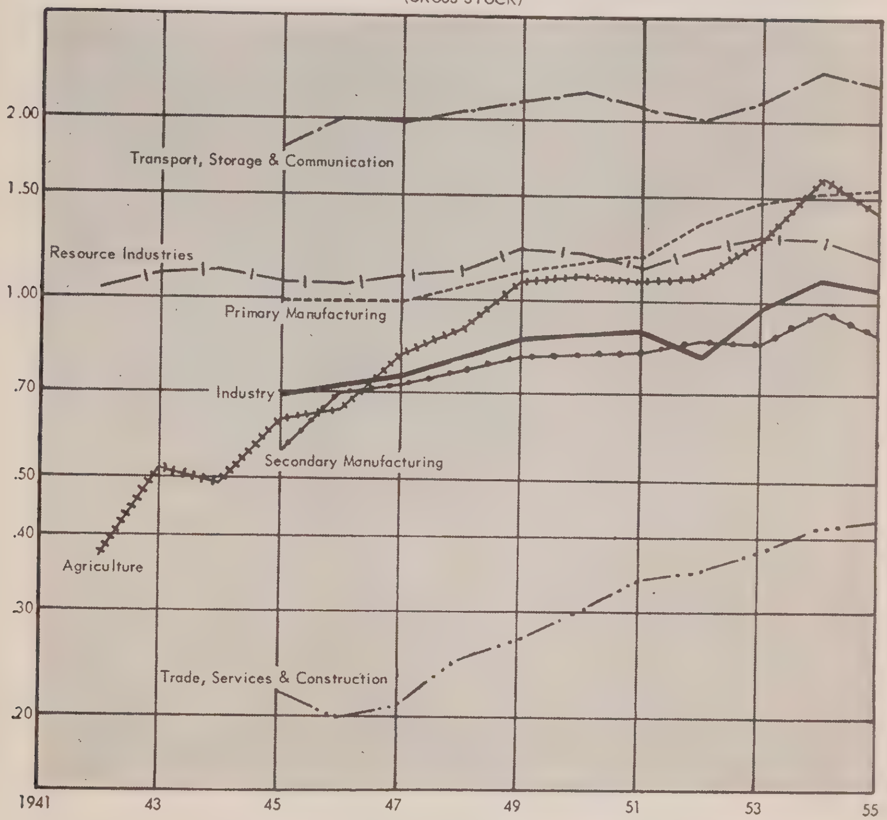


estimates for the whole economy since 1926, that the ratio for machinery and equipment has been rising slowly since the 1920's. Third, our more reliable estimates, commencing in 1945, suggest that the increase in the ratio of construction plus machinery and equipment to output is more dependent on change within each industry than shifts among industries (this was discussed in Part III). However, this last proposition covered only a short period of time, within which relative shifts in output were not large.

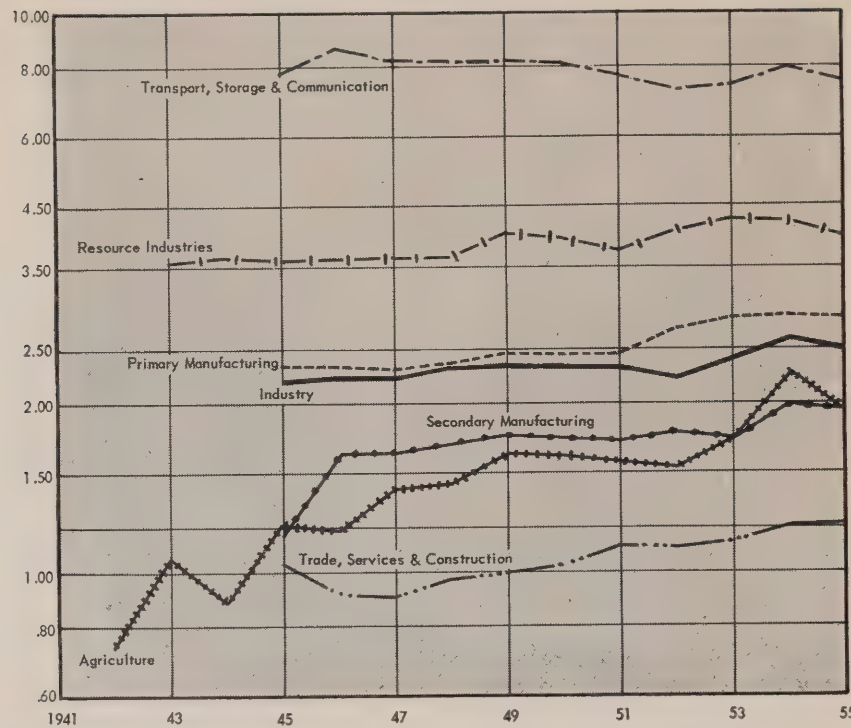
We must now turn to a fourth aspect, which is like the third: the effect of *future* shifts in output on the machinery and equipment ratio. To study this problem we should first know how machinery and equipment stock is divided among the sectors. We show the gross stock distribution for 1946 and 1955 in Table 6. 14; the interested reader may compare this with Table 6. 13.

CAPITAL—OUTPUT RATIO – MACHINERY AND EQUIPMENT
(GROSS STOCK)

Chart 6.5



CAPITAL OUTPUT RATIO – CONSTRUCTION AND MACHINERY AND EQUIPMENT (GROSS STOCK) Chart 6.6



Sources - Gross Stock; Appendix Table 6B. 2
G.D.P. Chapter 5

Table 6. 14

DISTRIBUTION OF GROSS STOCK OF MACHINERY AND EQUIPMENT, BY SECTOR

(percentage)

		1946	1955
I	Agriculture	16	19
II	Resource industries	12	12
III	Primary manufacturing	11	12
IV	Secondary manufacturing	25	22
V	Transport, storage and communication	28	20
VI	Trade, services and construction	9	14
	Total industry	100	100

SOURCE: Appendix B, Table 6B. 2, 8000.

Chart 6.7

MACHINERY AND EQUIPMENT – OUTPUT RATIOS, 1935 – 1955

RATIO OF GROSS STOCK OF MACHINERY AND EQUIPMENT TO GROSS DOMESTIC PRODUCT AT FACTOR COST BY SECTOR AND SELECTED INDUSTRIES (1949 PRICES)

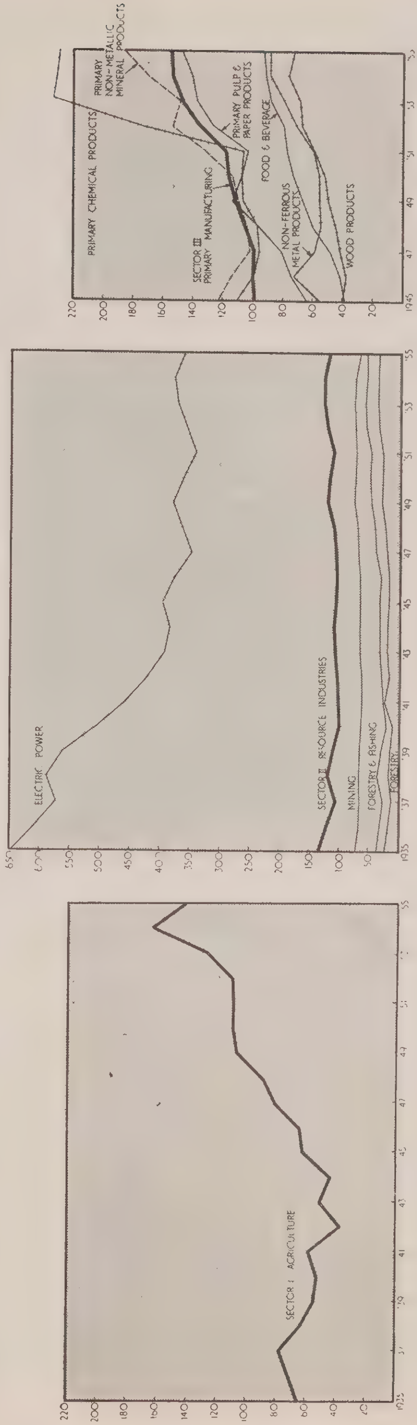


Chart 6.8

MACHINERY AND EQUIPMENT – OUTPUT RATIOS, 1935 – 1955

RATIO OF GROSS STOCK OF MACHINERY AND EQUIPMENT TO GROSS DOMESTIC PRODUCT AT FACTOR COST BY SECTOR AND SELECTED INDUSTRIES — 1949 PRICES

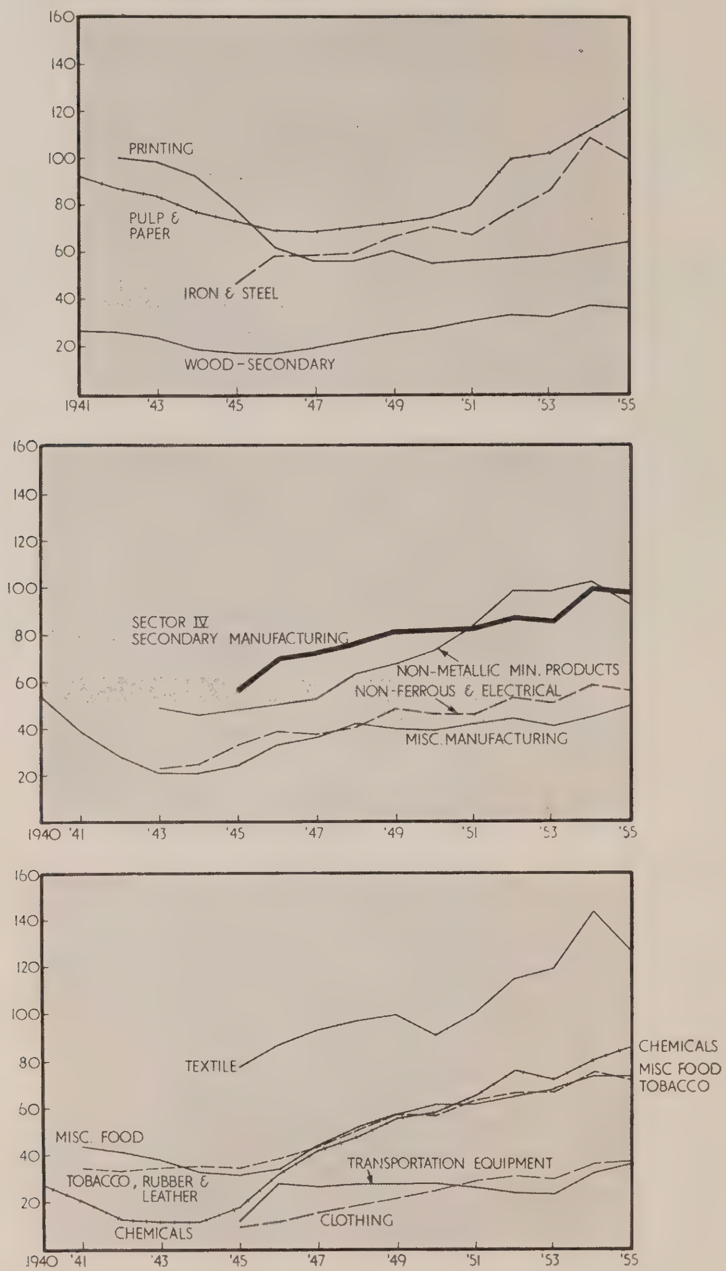
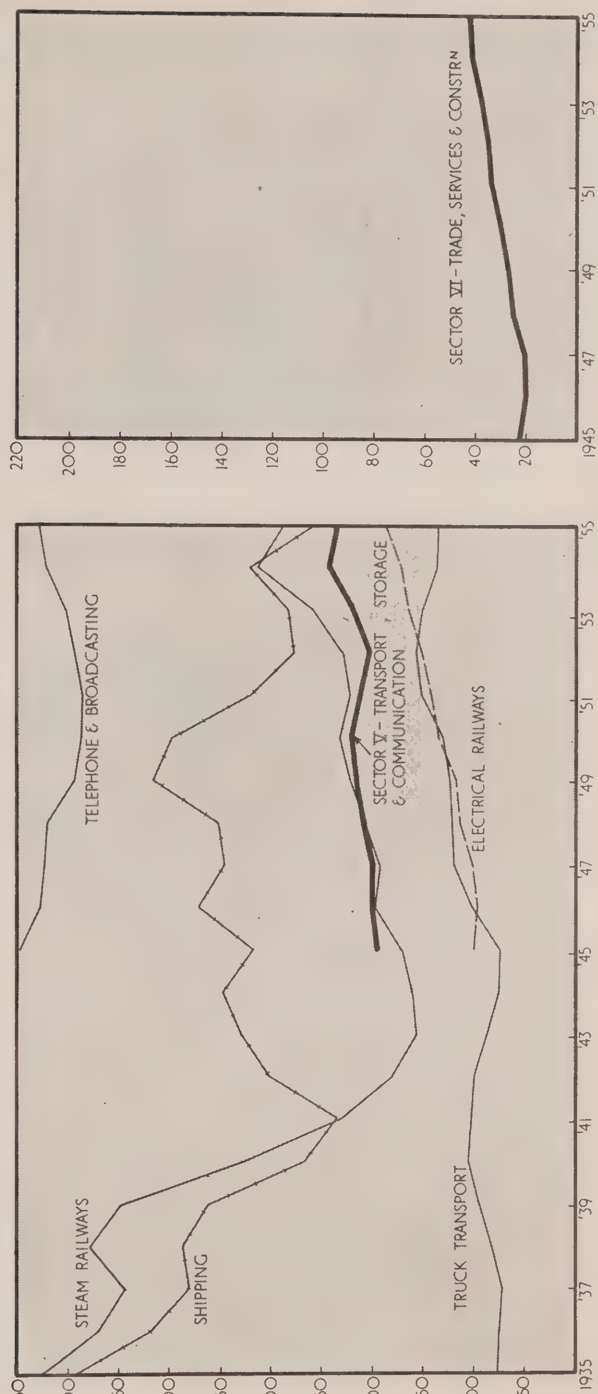


Chart 6.9

MACHINERY AND EQUIPMENT – OUTPUT RATIOS, 1935 – 1955

RATIO OF GROSS STOCK OF MACHINERY AND EQUIPMENT TO GROSS DOMESTIC PRODUCT AT FACTOR COST BY SECTOR AND SELECTED INDUSTRIES — 1949 PRICES



There is surprising evenness of distribution of the machinery stock. Agriculture by this calculation has about as much machinery and equipment as transport, storage and communication; and resource industries about as much as primary manufacturing and trade, services and construction. As mentioned in other connections, the big change has been the decline since 1946 in the share of transport, which now comes second to secondary manufacturing's share. More surprising is the increase in the use of equipment and machinery by trade, services and construction. This sector is a very mixed bag, and it is difficult to isolate any single force at work. The largest part of the machinery stock within the sector, held by wholesale and retail trade, appears to have increased by as much as five times since 1946. The next largest stocks (and with the next largest recent rates of growth) are in personal, business and recreational services and in the construction industry. Finance, insurance and real estate have increased their holdings rapidly (about five times) but are still relatively small users of machinery and equipment.

All this points, we believe, to very large possibilities of increase in the demand for machinery and equipment. Let us enumerate some of these possibilities. (The reader may wish to relate the discussion to the record shown in Charts 6. 6 to 6. 9.)

I. The capital-output ratio in agriculture will certainly continue to increase. This sector is now one of the biggest users of machinery. The decline that is forecast in the *relative* size of the industry (which is discussed in the agriculture study of the Royal Commission) will of course offset this rise in the ratio as far as total demand is concerned, but agriculture will nevertheless have a very important effect on total machinery demand. The forecast of farm output for 1980 is based upon an assumed high machine-man and machine-acre ratio; we expect the machine-output ratio to rise from 1.42 to 1.90.

II. Resource industries. A large user of capital in this sector is the power industry. There appears to be no doubt that future power requirements will call for more elaborate and expensive machinery and equipment per unit of power output than has ever been Canada's experience, regardless of whether future requirements are supplied by hydro-electric or by fuel sources. This belief applies as well to forestry, mining, and the oil industry. The winning of resources from the earth, as we have said of construction requirements, will, we expect, call for something more than "skimming the cream" off newly discovered sites. Planned, heavy and permanent installations will probably be particularly important in the mining and forestry fields; while the mere discovery of further petroleum resources will demand heavy investment in increasingly sensitive and potent (and ex-

pensive) exploratory equipment. For all these reasons we expect a considerable rise in the machinery capital-output ratio for this sector, from 1.20 to 1.65.

III. Primary manufacturing. As the reader will discover from reading the materials and export studies, we believe that the relative importance of this sector's output will remain about as it is in 1955. The data show recent increases in the machinery capital-output ratios of industries within this sector, especially primary chemicals and non-ferrous metals' smelting and refining. These industries are also growing relative to the whole sector. There is reason to believe also that any increase in the degree of manufacture of Canadian primary exports will probably raise its capital-output ratio for machinery. Only if exports remained heavily concentrated on unmilled wheat, newsprint and sawn timber, would we expect to see the machinery-output ratio here unaugmented over the next quarter century. We have forecast that this ratio will increase from 1.55 to 2.10 over the next 25 years.

IV. Secondary manufacturing. In this sector—which the Commission's studies suggest will slightly increase its present proportional fraction of output as a whole — we can make use of United States evidence as well as our own. Our own studies suggest that the machinery of manufacturing is becoming steadily more important with respect to both construction goods and output. This evidence has been confirmed by studies by both the United States Department of Commerce and the Machinery and Allied Products Institute. The latter body, in particular, talking about the United States mixture of industry, which is very like that in Canadian secondary manufacturing, anticipates a gradual increase in the capital-output ratio for machinery and equipment. Much of this rise is to be explained by the type of reasoning advanced earlier in connection with our analysis of the allied phenomenon of a decrease in the construction ratio; an increase in the already intensive use of mechanical methods in the rapidly growing industries enumerated in the Commission's secondary manufacturing study should produce a decided growth in the ratio, from the present .98 to about 1.30.

V. Transport, storage and communication. This sector will probably decline as a proportion of total Canadian output, though it is difficult to judge how the opening of the resource frontiers will affect the railways. Whatever happens to output, however, we can say that in this section, as in agriculture, we expect that

the railways, at least, will increase their machinery-output ratios as they move away, as far as technical substitutability will allow, from labour intensity and from the use of heavy construction. In the communication field, too, it is probable that some increased efficiency of machinery (leading to lower ratios), will in part be offset by the tendency to substitute machines for human operators, so that there may in this event be no fall in the communications machinery and equipment ratio. We have forecast an increase in the ratio for the whole sector, from 2.36 to 2.60.

VI. Trade, services and construction. We have already commented on the surprising recent increase in the ratio for this sector. We see no likelihood of a reversal unless the increasing importance of the service and trade industries is entirely dominated by an influx of able and willing service workers. Unless this unlikely cheapening of service personnel occurs, every increase in the demand for services, consequent on an increase in general income and in leisure, is likely to increase both the relative importance of the sector and (in order to make up for the shortage of workers) the machinery and equipment capital-output ratio of the sector. Since 1945 the ratio has doubled; we expect a further increase from .43 to .90.

This analysis seems to us to point directly to a pronounced increase in the ratio for every sector and in the over-all ratio. It must be admitted, however, that the effects of a shift of labour out of transport and into services, for example, is likely to offset in part the over-all increase caused by a general intra-industry increase. For even though the ratios for transport and trade are both growing, the ratio for the former is much larger than that for the latter (see Chart 6. 5), so that a shift of labour or of output will bring the average down. But this is the only large shift force we can see running counter to an expected rise in the over-all machinery and equipment ratio. In the absence of shifts, our forecasts would suggest an increase from 1.05 to 1.47. But, taking shifts into account as we must, the indications are that the ratio will be 1.40 in 1980.

Lest the possibility of a shift away from capital-using industries give alarm to those dependent on investment activity, it must be recalled that a shift in output proportions is not like a shift in the employment of a *given* labour force. We do not expect transport to decline *absolutely* in output. The investment of the recent past has not been dedicated so much to keeping transport workers equipped as to equipping other workers. Hence, a continuation of the shift of workers from highly capitalized industries does not imply an absolute decline in investment. Rather, the increase in the capitalization of the growing industries, and the increase in the capitalization of

those that are, like secondary manufacturing, just about keeping pace with the whole economy, are likely to set the tone toward an increasing over-all machinery expenditure.

Another possibility is that techniques will so change that *within every industry* there will be an increase in machine productivity and a decline in the machine ratios. This would be, for example, the consequence of a revolutionary new technique which could be applied in every portion of the economy. We would be foolish to claim that such an innovation will not occur; probably, in the next 50 years, it will. But we believe the whole economy is now so large, and so dependent on a relatively few basic industries, that the mere availability of a new technique would lead, perhaps temporarily, to an industrial revolution during which the required investment by the basic industries preparatory to wholesale use of the innovation would be as much as or greater than we now expect given the reasonable advance on known techniques. We obviously cannot predict revolutionary changes, or they would not be revolutionary; our information about the evolutionary changes now expected does not suggest to us that they will be highly capital-saving.

The history and the forecast of the two ratios is shown in Chart 6. 3. Taking the two ratios together, it will be seen that we are in effect predicting that the aggregate fixed gross capital-output ratio will rise very slowly over the next 25 years, until by 1980 it has approximately the level it had in 1928. That is, we believe that the over-all capital-output ratio will change very little over the long run, though there will be a redistribution as between machinery and structures. This belief is consistent with the record surveyed in Chapter 2 and the analysis in Chapter 3.

Once this decision was made, the forecasting procedure was fairly mechanical, though time consuming. For each year, 1955 to 1980, we set out (for construction):

1. Forecast of the G.D.P. for industry in 1949 dollars at factor cost. This is given in Chapter 5.
2. Forecast of the capital-output ratio for construction. This was discussed above.
3. Forecast of the "discards", or replacement needs. This was obtained from 8002.[17] The investment of year *n* is the discard of year n+L.
4. Capital gross stock. This was given by 1 x 2.
5. Increase in gross stock. This was gross stock of year *n* minus gross stock of n-1.

[17]See Appendix B.

6. Investment forecast. This was given by 5+3.
7. Depreciation. This was given by I/L x gross stock of preceding year.
8. Net investment. This was given by 6 - 7.
9. Net stock. This was given by the accumulation from 1955 of the items in 8.

For any future year n, then, we have the gross stock G_n from the forecast of the capital-output ratio and the forecast of output or G.D.P. Then, using the symbols of Part III:

$$I_n = I_{n-L} + (G_n - G_{n-1}),$$

$$\text{Depreciation} = \frac{1}{L} G_{n-1},$$

$$\text{Net Investment} = I_n - \frac{1}{L} G_{n-1}$$

$$\text{and Net Stock} = N_n = N_{n-1} + I_n - \frac{1}{L} G_{n-1}.$$

The same method was used for machinery and equipment as for construction.

Investment forecasts were made for each of the three G.D.P. forecasts of Chapter 5—the low extreme of the range, the high extreme and the middle of the range all based on immigration of 75,000 per year, using the same discard series and the same forecast capital-output ratios.

Forecasts were also made at 1955 prices. To do this the forecasts of investment expenditures were converted from 1949 prices to 1955 prices by means of the National Accounts' implicit price deflator. The 1955 value of this for machinery and equipment was 123.9; and for construction it was 137.2. These "price indexes" were assumed to remain unchanged over the whole period. That is, we assume that there would be no general pressure on the ability of the machinery industry and the construction industry to supply capital goods in the amounts required, so that the price of goods supplied by these industries would not rise relatively to prices in general. The calculation of gross stock and of depreciation was as given in Part III.

However, such investment forecasts, when converted into 1955 prices, had in part to cover replacement of discards of items purchased at earlier and lower prices. Hence, the value of the gross stock was each year reduced by discarding goods lower priced than those that replaced them in volume

terms. This meant that until all pre-1955 purchases had been discarded, the gross stock was in part valued at prices ruling before 1955: at prices less than the 1955 price index for new expenditure. Since depreciation is $\frac{1}{L} G_{n-1}$, the depreciation "in current dollars" of the year 1980 was in part influenced by the price level of construction goods in 1940-50.

Certain adjustments of the results were necessary:

(a) The forecast of construction was raised by approximately 8% to cover, for National Accounts purposes, expenditures for municipal schools and hospitals, religious institutions, universities, etc., as shown in the earlier comparison of industrial capital and National Accounts non-residential construction. The relative sizes of each of these non-industrial outlays is given in the Commission's study, *Housing and Social Capital*. No similar adjustment had to be made for forecasts of machinery and equipment investment.

(b) In depreciation forecasting, an 8% coverage adjustment similar to (a) was necessary.

(c) In addition it was necessary to add a forecast of residential depreciation. This was computed by the method outlined in the *National Accounts, Income and Expenditure, 1926-1950,* page 102. The non-farm residential depreciation was taken as 17.5% of the adjusted gross space rent in current dollars as forecast in the consumption study. This percentage was the 1980 trend value of the ratio from 1949 to 1955.

(d) Finally, it was necessary to adjust our depreciation forecast to coincide with the level of depreciation estimated in the past for the National Accounts from National Revenue Department's "Taxation Statistics" and other sources. (See *National Accounts, 1926-1950,* pages 101-103 for the methods used.) Table 6. 15 shows for selected years the ratio of non-residential depreciation as computed for the National Accounts to depreciation at original cost as computed by our accumulations 8002. It should be recognized that a small part of the difference is accounted for by private institutions. The rest can be described as some combination of incentive depreciation allowance by the tax authorities, underestimate of true depreciation by the present study, bad debt losses, and claim portion of industrial insurance.

We believe that a good deal of the recent large tax depreciation allowance has been made necessary by the rapid increase in the replacement cost of discarded capital goods, by the exigencies of defence efforts and for special incentive purposes. By 1980, however, we assume that 25 years of price

stability and of peace will have passed, so that it is unlikely that such a large percentage difference will exist between computed and National Accounts' depreciation. We have, therefore, for 1980, added to our computed depreciation not only the coverage adjustment of 8% mentioned in (b) above, but a further 10%. This raises depreciation (excl. residential depreciation) for 1980 to almost 120% of our original calculation, a figure comparable to the 163% shown for 1954 in the table.

Table 6. 15

ESTIMATES OF DEPRECIATION, 1926-55

(in original prices)

	National Accounts non-residential[a]	Industrial Capital Study, total industrial depreciation[b]	Ratio
1926	460.4	418.4	1.10
1927	560.8	427.9	1.31
1928	552.3	438.7	1.26
1929	596.8	453.5	1.32
1930	570.0	480.8	1.19
1931	507.4	505.1	1.00
1932	465.8	511.5	.91
1933	455.5	500.8	.91
1934	414.2	486.0	.85
1935	427.6	473.4	.90
1936	438.5	457.4	.96
1937	471.8	449.1	1.05
1938	477.4	456.5	1.04
1939	504.2	456.7	1.10
1940	609.9	457.8	1.35
1941	743.1	469.3	1.58
1942	882.7	490.6	1.80
1943	864.1	507.4	1.70
1944	830.1	515.2	1.61
1945	793.8	524.7	1.51
1946	768.7	538.7	1.43
1947	970.1	570.3	1.70
1948	1,112.9	639.5	1.74
1949	1,254.1	729.6	1.72
1950	1,423.3	824.5	1.73
1951	1,674.6	923.5	1.81
1952	1,853.8	1,050.6	1.76
1953	2,115.7	1,189.6	1.78
1954	2,182.8	1,340.5	1.63
1955		1,476.8	

a As shown in *National Accounts Income and Expenditure, 1926-50 and 1950-55*, minus farm and non-farm residential depreciation.

b From 8002; I/L Gn—1 for machinery and equipment and for construction at original cost. No coverage adjustment has been made.

The results of these operations on the original forecasts of investment and of depreciation are shown in Table 6. 16.

Table 6. 16

FORECASTS OF INVESTMENT AND DEPRECIATION, 1980

(National Accounts definitions, $ 1955 millions)

	High G.D.P.[a] forecast	Middle G.D.P.[a] forecast	Low G.D.P.[a] forecast
	Investment		
Construction investment			
Original calculations ($ 1955)	4,263.6	3,691.5	3,183.6
Add coverage adjustment (8% of medium forecast)	295.3	295.3	295.3
Total	4,558.9	3,986.8	3,478.9
Machinery and equipment investment	8,403.5	7,647.5	6,891.7
Total investment	12,962.4	11,634.3	10,370.6
	Depreciation		
Construction depreciation			
Original calculations	2,181.6	2,000.5	1,823.0
Add coverage adjustment (8% of medium forecast)	160.0	160.0	160.0
Total	2,341.6	2,160.5	1,983.0
Machinery and equipment depreciation	5,853.8	5,253.1	4,961.1
Total industrial depreciation	8,195.4	7,513.6	6,944.1
National accounts adjustment (x 1.10)	9,014.9	8,265.0	7,638.5
Housing depreciation	850.0	805.0	780.0
Total depreciation	9,864.9	9,070.0	8,418.5

a For explanations of the three G.D.P. forecasts see Chapter 5, Table 5. 20 and Appendix A of Chapter 5. The high and low forecasts refer to alternative assumptions concerning the average annual compound rate of increase of G.D.P. per man-hour in the business sector of the economy. The middle forecast is the arithmetical average of the high and low forecasts.

Similar investment and depreciation estimates were made for intervening years, 1955 to 1980. The results are shown in Table 6. 17. The same methods were used in making forecasts of investment for intervening years as for 1980, and the same adjustments were made to bring them into harmony with the National Accounts' concepts. With respect to the depreciation forecasts, however, the following modifications were made:

(a) The National Accounts adjustment for depreciation descends from 163% in 1954 to 110% by 1980 as shown by line 10.

(b) The absolute amount of housing depreciation varies with the gross space rent as forecast in the consumption study. The amount is shown in line 12.

Table 6. 17

FORECASTS OF INVESTMENT AND DEPRECIATION, 1955-80

(National Accounts definitions, $ 1955 millions)

	1955	1960	1965	1970	1975	1980
	Investment					
Construction investment						
1. Original calculation	1,601.2	2,245.8	2,398.5	3,282.5	3,054.8	3,691.5
2. Coverage adjustment (x 1.08)	1,729.3	2,425.5	2,590.4	3,545.1	3,299.2	3,986.8
3. Machinery and equipment investment	2,017.0	2,150.0	3,472.5	4,564.0	5,456.1	7,647.5
4. Total investment	3,746.3[a]	4,575.5	6,062.9	8,109.1	8,755.3	11,634.3
	Depreciation					
Construction depreciation						
5. Original calculation	416.0	607.9	856.1	1,198.8	1,572.1	2,000.5
6. Coverage adjustment (x 1.08)	449.3	440.5	924.6	1,294.7	1,697.9	2,160.5
7. Machinery and equipment depreciation	1,060.8	1,561.0	2,237.6	3,068.5	4,073.8	5,253.1
8. Total industrial depreciation	1,510.1	2,001.5	3,162.2	4,363.2	5,771.7	7,513.6
National Accounts adjustment						
9. Rate[b]	(165%)	(154%)	(143%)	(132%)	(121%)	(110%)
10. Adjusted depreciation	2,491.7	3,082.3	4,521.9	5,759.4	6,983.8	8,265.0
11. Add housing depreciation[c]	350.1	396.6	472.5	542.5	677.3	805.0
12. Total depreciation	2,841.8[a]	3,478.9	4,994.4	6,301.9	7,661.1	9,070.0

a 1955 estimates do not correspond exactly with National Accounts data since coverage adjustments are averages for several years. In some cases, preliminary data used in the actual calculations were slightly lower than those eventually published in *National Accounts 1950-55.*

b Trend from 163% which held in 1954 to 110% in 1980. Rate for 1955 estimated by extrapolation. See text and Table 6. 3.

c 17.5% of forecast of gross space rent. See text.

It is difficult to comment on these results without taking account of other items of the G.N.E. The reader is therefore referred to Chapter 7, where the investment forecast is shown in its context as a part of the over-all use of goods and services forecast in the G.N.P. of Canada in 1980. A few notes, however, may point out matters of interest.

(a) In the past few years machinery and equipment and construction in the National Accounts', non-government non-housing sense, have been running at about 15% of the G.N.E. The future forecast is also that such investment will absorb 15% of the G.N.E.

(b) However, from an almost even distribution between plant and machinery today, we forecast a shift to a situation in which only one-third is new plant investment and two-thirds is machinery.

(c) Taken in conjunction with the housing forecast, and the construction part of the government forecast (for which see the study *Housing and Social Capital*) it would appear that the total of private and public investment will be a slightly lower percentage of G.N.E. than today.

(d) Looking at private and public construction outlays only, it appears that the construction industry will not be as active, or as large, relative to the whole economy, as today. The machinery industry, on the other hand, is likely to be competing with imported machinery and equipment for a larger market than today's.

(e) Since construction has taken place in the past in a discontinuous way, replacement requirements of the future are likely also to be discontinuous. In our forecast there will be a wave of replacement demand in the middle of the forecast period, from the middle 1960's to about 1970. The year 1980, however, will not be a particularly active period in this sense.

7

DIVISIONS OF EMPLOYMENT OUTPUT AND EXPENDITURES

I. *Introduction*

In this final chapter we report on forecasts of broad components of the aggregates whose magnitudes have been our primary concern to this point. The word "report" has been chosen deliberately, as many of the forecasts we shall refer to have been prepared by others and are discussed and described in other studies. Our main object is to show how the forecasts of components compare with each other, with the aggregates studied in this book and with the record of past relationships.

We hope that the results reported here are broadly consistent with each other and that the reader will find them so. All those who have contributed results to this chapter have been conscious of the need to view their forecasting assignments in the large and to modify their own results or seek modification of the results of others as the fruits of our work became available for comparison. Considerable effort was spent by each forecaster in studying the work in progress and results of others, and extended group discussions were held from time to time in order to eliminate gross inconsistencies and thus make the maximum possible use of all information at hand in arriving at each forecast. However we have not surmounted all the difficulties in the way of rendering our results consistent.

Two main difficulties hindered the efforts to achieve consistency; one was technical in character, the other was not. Considering the latter first, it must be remarked that the task undertaken by the forecasters was a very elaborate one for the time that could be made available. The time that could be given to revising and integrating forecasts and their supporting explanations was rather stringently rationed. One consequence may be mentioned to aid the reader in interpreting our work. In principle, forecasts of aggregates of output and expenditure should be considered as tentative until examined in the light of forecasts of their components, just as fore-

casts of each component should be regarded as tentative until examined in the light of forecasts of other components and of the aggregate. In principle both the aggregate and the components should be subject to adjustment at the time of reconciliation. As a matter of practical necessity however, we had to limit our adjustments, following the examination of tentative results, to the forecasts of components. As a consequence the forecasts of aggregates reported above are the ones made at a rather early stage of the Commission's work. In some cases, as for example in the case of agricultural output and employment, minor discrepancies remain between results reported in this study and forecasts described in the special study of agriculture.

The technical difficulty relating to the integration of results arises from the limitations of the techniques available. Economists are not yet as adept as they would wish at tracing in the records of past performance the interrelations of changes in various parts of the economy. It is not surprising then that technical difficulties obstruct them in tracing the interrelations of *expected* changes. In Appendix A to this chapter the reader may find a very short essay on some of these technical problems. But enough of difficulties (or excuses!); let us come to the main business of this chapter.

Forecasts both of demand for and supply of goods and services are reported below. Inasmuch as demand and supply are always inextricably linked together, there can be no logical order in which to present the results. We shall give first the forecasts of employment in or about 1980 in the major industrial groupings and compare these forecasts with the records of employment since 1926. Forecasts of output (as measured by G.D.P. at factor cost) for the same groups of industries are then given and compared with the records as far back as we have them. Turning then to the demand for goods and services, we present forecasts of expenditures by the categories of expenditure usually delineated in the National Accounts. These forecasts for 1980 are also compared with the records of expenditure from 1926 to the present. Next, forecasts for 1980 of saving and investment and the main components of each are reported and related to the developments since 1926. The chapter concludes with a few observations on the interval between now and 1980.

II. *Employment by Industries*

In Chapter 5, we presented forecasts for 1980 of employment in three main sectors of the economy, agriculture, business, and government and community services, using alternative assumptions as to net immigration. The forecasts presented here are all based on the assumption that net immigration will amount to 75 thousand persons per annum, and they give more

detail for the business sector of the economy, which is here divided into five groups of industries: (a) resource industries (including forestry, fishing, mining, quarrying and oil wells, and central electric stations), (b) primary manufacturing, (c) secondary manufacturing (for details of the manufacturing classification see Appendix C of Chapter 6), (d) construction, (e) transportation, storage and communication together with trade, finance and services. We also restate our forecasts of employment in agriculture and government and community service.

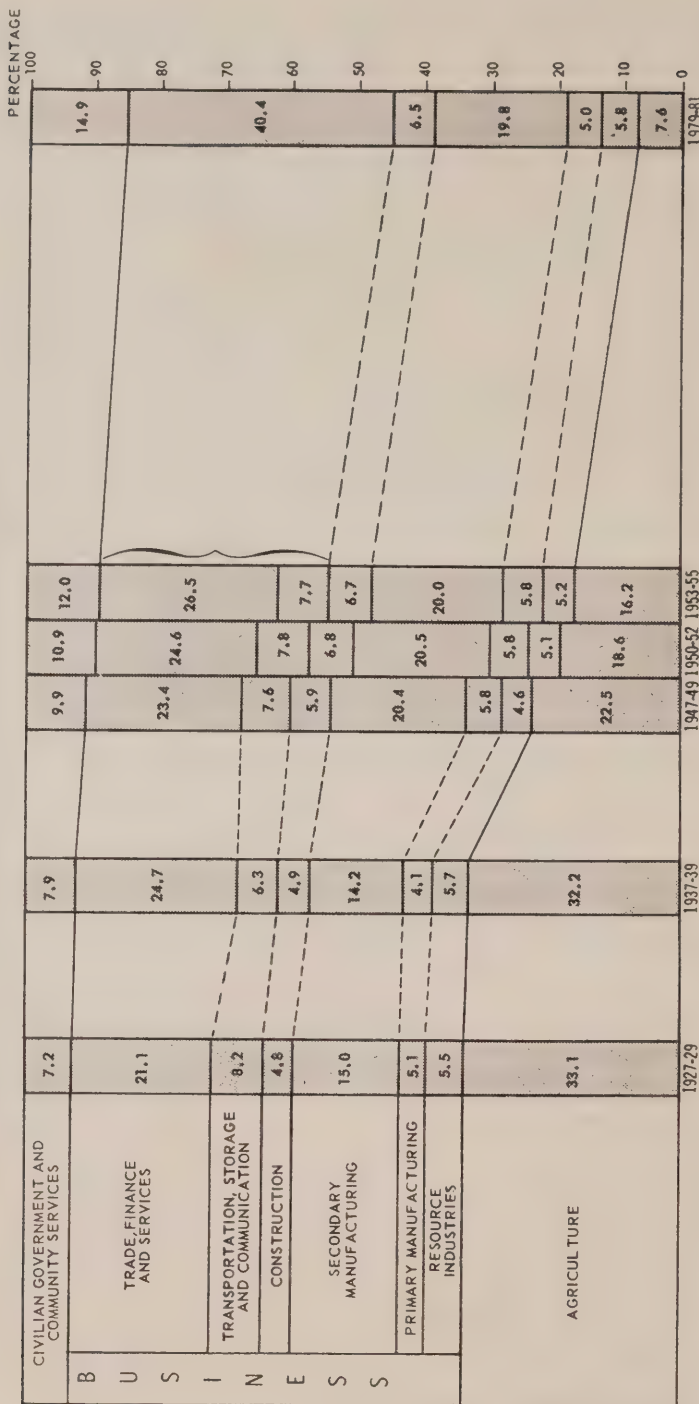
In the studies devoted to the prospects for the resource industries, primary manufacturing and secondary manufacturing, more detailed forecasts of the distribution of employment within these sectors may be found. The study of the service industries may be consulted for further detail on the prospects in this area, although differences between classifications used impede comparison of the numerical results shown in this chapter with the forecasts given in the services study. In this chapter the trade, finance and services and the transportation, storage and communication groups of industries have been considered together. The forecasts of both employment and output in this large, diversified sector are essentially residual forecasts. The special work done in the services study and results of other specific pieces of research were used in evaluating the result, but the sector is too diversified and our detailed knowledge of its record too limited to permit more systematic treatment. We like to think that if it is necessary to forecast employment in a sector residually, the diversity of the sector is an advantage.

The record and the forecasts are summarized in Table 7. 1 and in Chart 7. 1. The total civilian employed labour force is expected in 1980 to be some 80% to 85% larger than its average figure over the years 1953 to 1955. By 1980 it will include nearly ten million workers.

Over the quarter century since the late '20's the most striking changes in the distribution of the total employed labour force have been the decline in the proportion of workers in agriculture, the rise in the proportion in the trade, finance and services sector, and the rise in the proportion in the government and community services sector. The proportions in resource industries and primary manufacturing have remained virtually unchanged. The proportion in secondary manufacturing rose substantially over the war years. Immediately after the war it declined, but only to a level considerably higher than in the prewar period, and it has since remained constant. There has been a rise of about two percentage points in the share of the construction industry in the last 25 years. In Appendix B a table is shown giving the percentage distribution of the labour force for each year from 1926 to 1955.

Chart 7.1

INDUSTRIAL DISTRIBUTION OF CIVILIAN EMPLOYED LABOUR FORCE



Source: Table 7.1

Table 7. 1

INDUSTRIAL DISTRIBUTION OF THE CIVILIAN EMPLOYED LABOUR FORCE AVERAGES FOR SELECTED YEARS 1926-55, FORECAST FOR 1979-81

(thousands)

	1927-29	1937-39	1947-49	1950-52	1953-55	1979-81
Agriculture	1,217	1,274	1,099	948	849	735
Resource industries	202	227	223	259	273	555
Primary manufacturing	188	164	283	293	304	486
Secondary manufacturing	552	565	1.002	1,046	1,050	1,907
Total manufacturing	740	729	1,285	1,339	1,354	2,393
Construction	175	194	288	344	351	625
Transportation, storage and communication	301	249	371	400	406	—
Trade, finance and services	775	982	1,143	1,248	1,392	—
Total transporataion, trade and services, etc.	1,076	1,231	1,514	1,648	1,798	3,890
Total business	2,193	2,382	3,309	2,589	3,775	7,463
Civilian government and community services	263	313	484	556	631	1,439
Total	3,675	3,969	4,893	5,093	5,256	9,637

(percentage)

	1927-29	1937-39	1947-49	1950-52	1953-55	1979-81
Agriculture	33.1	33.2	22.5	18.6	16.2	7.6
Resource industries	5.5	5.7	4.6	5.1	5.2	5.8
Primary manufacturing	5.1	4.1	5.8	5.8	5.8	5.0
Secondary manufacturing	15.0	14.2	20.4	20.5	20.0	19.8
Total manufacturing	20.1	18.3	26.2	26.3	25.8	24.8
Construction	4.8	4.9	5.9	6.8	6.7	6.5
Transportation, storage and communication	8.2	6.3	7.6	7.8	7.7	—
Trade, finance and services	21.1	24.7	23.4	24.6	26.5	—
Total transportation, trade and services, etc.	29.3	31.0	31.0	32.4	34.2	40.4
Total business	59.7	59.9	67.6	70.5	71.8	77.5
Civilian government and community services	7.2	7.9	9.9	10.9	12.0	14.9

NOTE: Detail does not always add to totals because of rounding.
SOURCE: Estimates for 1926-55, Chapter 5, Appendix F.

For the most part these gradual changes in the industrial distribution of the employed workers in Canada are expected to continue. The agricultural labour force will, it is thought, continue to decline, though at a diminishing rate. Agriculture's share of the labour force in 1980 at 7% or 8% is expected to be about half of its average level from 1953 to 1955. The share of the resource industries may increase fractionally, while the share of primary manufacturing may diminish fractionally. Together these two related groups of industries will continue to employ just over 10% of the working population. Secondary manufacturing industries will continue to engage about one-fifth of the employed labour force, while primary and secondary manufacturing industries together will continue to account for about one-quarter of it. Changes in the share of the construction industry will be negligible between now and 1980. The share of the service industries including transportation (and allied industries) and government will continue to grow, rising by nine or ten percentage points from 46% to 55% or 56%.

The largest relative gains in employment (that is the increase in employment to 1980 as a percentage of average employment in the last three years) will be shown in the resource industries and in the broad service category that includes transportation and government. The secondary manufacturing and construction industries will experience about equal relative gains (approximately 80%) while primary manufacturing industries will increase their employment by some 60% (see Table 7. 1).

III. *Output by Industries*

The forecasts of the division of output by industries given in this part provide detail for the business sector which was not given in Chapter 5. There are, however, no alternative forecasts for different assumptions concerning the rate of immigration or the rate of increase of productivity in the business sector. The forecasts are based on the assumptions that the balance of immigration over emigration will be 75 thousand persons annually and that output per man hour in the business sector will increase at an annual compound rate of two and two-thirds percent.* Output is measured as G.D.P. at factor cost and excludes residential rents; the contribution of the armed services to output is also excluded.

As in the case of employment, more detailed forecasts may be found in other studies, though the concept of G.D.P. has not been used in all of the Commission's industry studies. The trade, finance and services sector and the transportation, storage and communication sector have again been treated together and the forecast of output obtained residually for the reasons given in Part II. There was even less detailed information on output than on

*It was intended to base the calculation on the average of the rates 2.50% and 3.25% but an arithmetical error discovered very late implies the assumption stated.

employment for this combined sector in the special studies on which we have drawn.

The record and the forecasts are summarized in Table 7. 2 and in Chart 7. 2. The G.D.P. apart from that contributed in the armed services sector and apart from residential rents is expected in 1980 to be nearly three times its value on the average from 1953 to 1955. In 1980 it is expected to amount to over 50 billion dollars (in 1949 values).[1]

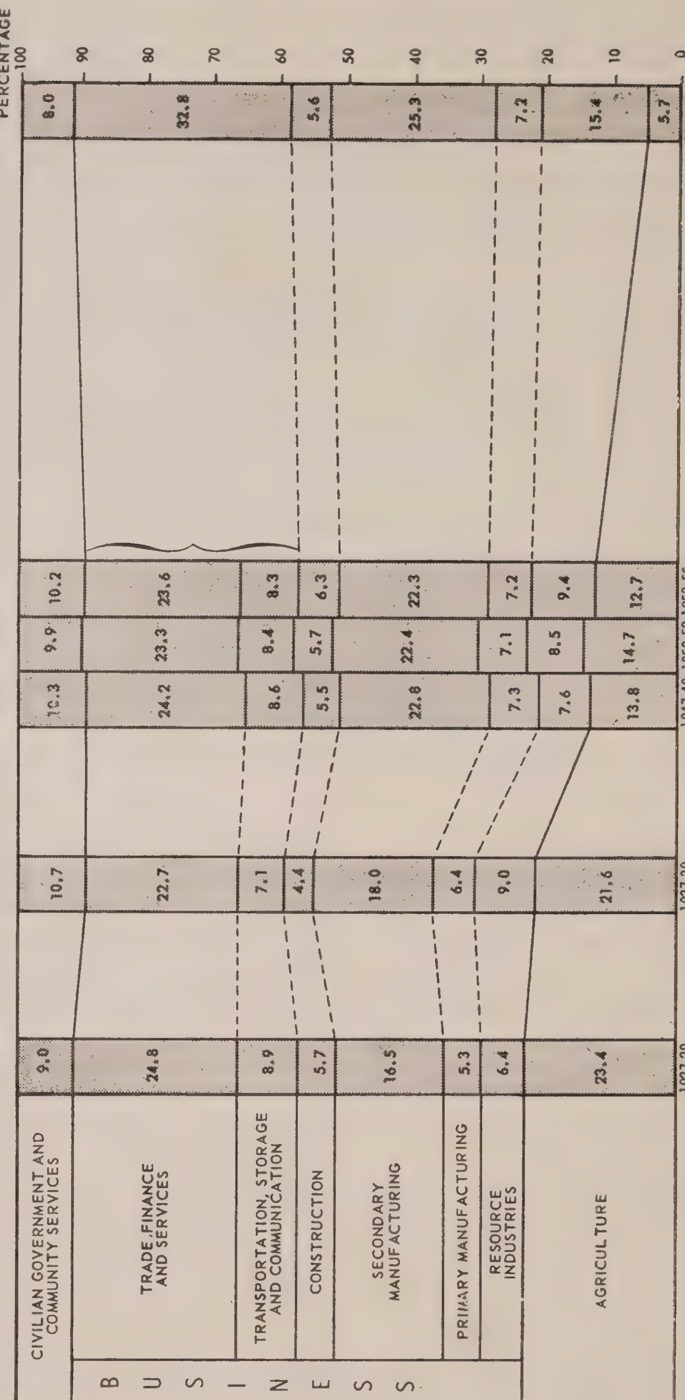
In the quarter century since the late 1920's some industries have contributed a remarkably constant share of the total output. The construction industry and the transportation, trade and services group of industries have each shown very little change over this period. The share of the government and community services sector has also shown very little variation. Indeed, according to our records, the share of the service industries including transportation, government and community services was, at just over two-fifths, almost exactly the same in the 1927 to 1929 period as it was in the 1953 to 1955 period. The share of agricultural output in the total has declined from just under one-quarter to slightly under one-eighth. The relative contributions of the resource and manufacturing industries have increased substantially in the last generation. Together, their contributions stand at about 38% now, whereas they were about 28% in the late '20's. In Appendix C a table is presented showing the percentage distribution of G.D.P. by industries for all years 1926 to 1955.

In the quarter century to come the resource industries and the manufacturing industries will continue to increase their proportionate share of total output, though in the manufacturing sector the major contribution to this increase will come from the secondary industries. The manufacturing and resource industries are expected to increase their combined proportionate contribution to total output from 38% or 39% to about 48%. The construction industry is expected to contribute a slightly smaller proportion of output than it has done in the last three years, but at some 5% or 6% in 1980 its share will be in the same range as in the late '20's and the first half-dozen postwar years. The service and transportation industries together with governments probably will contribute approximately the same share of output as they have for the last two to three decades. The proportion of output deriving from agriculture will, however, be more than cut in half. The average agricultural share for 1953 to 1955 was just over one-half of that for 1927 to 1929.

[1]It will be recalled that the record of G.D.P. has been constructed by using 1949 values of the outputs of various industries as weights with which to combine index numbers and other indicators of output, thus the record is in terms of 1949 values. We have shown the forecast similarly in 1949 values.

Chart 7.2

INDUSTRIAL DISTRIBUTION OF GROSS DOMESTIC PRODUCT (Excluding residential rents and G. D. P. arising in armed forces sector)



Source: Table 7.2

Table 7. 2

INDUSTRIAL DISTRIBUTION OF GROSS DOMESTIC PRODUCT[a]

AVERAGES FOR SELECTED YEARS 1926-55, FORECAST FOR 1979-81

(billions of 1949 dollars)

	1927-29	1937-39	1947-49	1950-52	1953-55	1979-81
Agriculture	2.01	1.85	1.89	2.32	2.22	2.91
Resource industries	.55	.77	1.04	1.34	1.64	7.85
Primary manufacturing	.45	.55	1.00	1.13	1.25	3.70
Secondary manufacturing	1.42	1.54	3.12	3.54	3.88	12.90
Total manufacturing	1.87	2.09	4.12	4.67	5.13	16.60
Construction	.49	.38	.75	.91	1.10	2.85
Transportation, storage and communication	.76	.61	1.18	1.33	1.44	—
Trade, finance and services	2.12	1.95	3.31	3.68	4.13	—
Total transportation, trade and services etc.	2.88	2.56	4.49	5.01	5.57	16.72
Total business	5.80	5.80	10.40	11.93	13.45	46.23
Civilian government and community services	.78	.92	1.41	1.57	1.77	4.08
Total	8.58	8.57	13.70	15.82	17.44	51.00

(percentage)

	1927-29	1937-39	1947-49	1950-52	1953-55	1979-81
Agriculture	23.4	21.6	13.8	14.7	12.7	5.7
Resource industries	6.4	9.0	7.6	8.5	9.4	15.4
Primary manufacturing	5.3	6.4	7.3	7.1	7.2	7.2
Secondary manufacturing	16.5	18.0	22.8	22.4	22.3	25.3
Total manufacturing	21.8	24.4	30.1	29.5	29.5	32.5
Construction	5.7	4.4	5.5	5.7	6.3	5.6
Transportation, storage and communication	8.9	7.1	8.6	8.4	8.3	—
Trade, finance and services	24.8	22.7	24.2	23.3	23.6	—
Total transportation, trade and services, etc.	33.7	29.8	32.8	31.7	31.9	32.8
Total business	67.6	67.7	75.9	75.4	77.1	86.3
Civilian government and community services	9.0	10.7	10.3	9.9	10.2	8.0

a Excluding residential rents and G.D.P. arising in armed forces sector.

NOTE: Detail does not always add to totals because of rounding.

SOURCE: Estimates for 1926-55, Chapter 5, Appendix F.

If however we consider for each sector the increases in output between now and 1980 as a percentage of average values in the period 1953 to 1955, we find that the resource industries are expected to lead by a wide margin. Their output may increase by as much as 380%. Included here are the outputs of central electric stations, oil wells, mines and the forests. The output of primary manufacturing is expected to increase by 200% and that of secondary manufacturing by 230%. The output of the transportation, trade and services group may also increase by some 200%, while that of the construction industry and government will increase by lesser amounts: 160% and 130% respectively.[2] Agricultural output is expected to increase by only 30% (see Table 7. 3).

In Table 7. 3 percentage increases in output per worker employed are summarized. Output per employed worker is expected to increase by some 60% between now and 1980 over all industries considered together. In the resources industries the increase in this rough measure of productivity may be over twice as large. In the construction, transportation, trade and services industries and in agriculture, the increase in output per worker will be less than the average for all industries. In manufacturing it is thought that output per worker may increase 80% to 85% by 1980.

Table 7. 3

PERCENTAGE INCREASES IN OUTPUT, EMPLOYED LABOUR FORCE, AND OUTPUT PER EMPLOYED WORKER FROM 1953-55 TO 1980

	Employed labour force	Output	Output per employed worker
	%	%	%
Agriculture	—35	30	50
Resource industries	100	380	135
Primary manufacturing	60	200	85
Secondary manufacturing	80	230	80
Total manufacturing	75	220	83
Construction	78	160	45
Total transportation, trade and services, etc	115	200	40
Total business	100	225	65
Civilian government and community services	130	130	0
All sectors shown above	83	190	60

IV. *Classes of Expenditure*

In Chapter 5 we presented forecasts of the G.N.P. This total value of production is equal, by definition, to the total value of expenditure known as Gross National Expenditure. We wish now to report on forecasts that have

[2]It will be recalled from Chapter 5 that for statistical and other reasons it has been assumed that output per man in the government and community services sector will be constant.

been made of expenditures in the various classes into which G.N.E. is usually divided.

The forecasts now to be presented are all based on the assumption that annual net immigration will amount to 75 thousand persons. But a high, low and middle forecast is presented for each class of expenditure. The high and low are based on the assumptions that output per man-hour will increase at the annual compound rates of 2½% and 3¼%, respectively. The middle forecast is of the division among expenditure classes of the average of the two forecasts of G.N.E. that derive from the two extremes of the productivity assumption.

The forecast of G.N.P. presented in Chapter 5 was expressed in 1949 dollars. The forecasts presented here, however, are expressed in 1955 dollars. The conversion of the G.N.E. from 1949 values to 1955 values was accomplished simply by multiplying the figure in 1949 prices by the ratio of prices in 1955 to prices in 1949. In each case prices were measured by the index published regularly by D.B.S. with the National Accounts estimates and known generally as the "implicit price deflator" for G.N.E.[3]

While we have stated values in familiar 1955 dollars, this must not be interpreted as an assertion that there will not be a change between now and 1980 in the general level of prices of the goods and services produced by Canadians. There undoubtedly will be changes in the general level of such prices and, moreover, price changes will not be uniform for all goods and services. In some instances forecasters allowed for the effects of offsetting changes in the prices of particular kinds of goods or services. It must be emphasized however, that the staff of the Commission has not attempted a comprehensive forecast of the general price level or of changes in relative prices. Some aspects of the difficulties of forecasting changes in relative prices and of incorporating the effects of these changes in other forecasts are mentioned in Appendix A to this chapter.

As with the other forecasts reported in this chapter the forecasts of the division of expenditure given here have drawn upon the results of several other studies. These include in particular the studies of exports, imports, consumer expenditure, social capital and a special study of the revenues and expenditures of governments. Further detail of exports and imports of particular commodities and services, of consumer expenditures and of demands for social capital may be found in these studies. The staff work on industrial capital has been reported in Chapter 6 of this study.

A synopsis of the record of the division of expenditure and the three alternative forecasts of this division are shown in Table 7. 4. In Appendix D more complete detail on the record for each year since 1926 may be found in four tables showing the division of expenditure in current dollars and constant (1949) dollars and each of these in absolute and percentage terms.

[3]The ratio referred to in the text had the value 1.233.

Table 7. 4

THE DIVISION OF GROSS NATIONAL EXPENDITURE, AVERAGES FOR SELECTED YEARS 1926-55; FORECASTS FOR 1979-81

	(billions of current dollars)					1979-81 (billions of 1955 dollars)		
	1927-29(a)	1937-39	1947-49	1950-52	1953-55	Low	Middle	High
Personal expenditure on consumer goods and services	4.30	3.83	10.08	13.22	15.94	45.1	49.1	52.8
Government expenditure on goods and services	.61	.71	1.83	3.27	4.51	11.9	12.7	13.7
Private fixed domestic investment	1.01	.62	2.59	3.76	4.92	12.8	14.2	15.7
Investment in inventories and error of estimate	.16	.14	.57	.95	.32	1.0	1.2	1.3
Exports less imports	—.12	.13	.20	—.23	—.51	—.5	—1.0	—1.5
Total Gross National Expenditure	5.97	5.43	15.28	20.97	25.18	70.3	76.2	82.0
Government current non-defence expenditure	.43	.49	1.06	1.32	1.64	6.3	6.8	7.4
Government non-defence investment expenditure	.16	.17	.50	.80	1.07	2.7	2.9	3.1
Government defence expenditure	.02	.05	.27	1.15	1.80	2.9	3.0	3.2
New residential construction	.23	.17	.63	.79	1.23	2.3	2.6	2.9
New non-residential construction	.40	.18	.77	1.28	1.71	3.5	4.0	4.6
New machinery and equipment	.38	.27	1.19	1.69	1.98	7.0	7.6	8.2
Exports of goods and services	1.67	1.46	3.90	4.95	5.43	13.4	14.1	14.8
Imports of goods and services	1.79	1.33	3.70	5.18	5.95	13.9	15.1	16.3
				(percentage)				
Personal expenditure on consumer goods and services	72.0	70.5	66.0	63.0	63.3	64.2	64.3	64.4
Government expenditure on goods and services	10.3	13.1	12.0	15.6	17.9	16.8	16.7	16.7
Private fixed domestic investment	17.0	11.4	17.0	17.9	19.5	18.2	18.6	19.2
Investment in inventories and error of estimate	2.7	2.5	3.7	4.6	1.3	1.4	1.6	1.7
Exports less imports	—2.0	2.5	—1.3	—1.1	—2.0	— .6	—1.3	—1.9
Government current non-defence expenditure	7.2	9.1	7.0	6.3	6.5	8.9	8.9	9.0
Government non-defence investment expenditure	2.7	3.1	3.2	3.8	4.3	3.8	3.8	3.8
Government defence expenditure	.3	.9	1.8	5.5	7.1	4.1	3.9	3.9
New residential construction	3.9	3.2	4.1	3.8	4.9	3.3	3.4	3.5
New non-residential construction	6.7	3.2	5.1	6.1	6.8	5.0	5.2	5.6
New machinery and equipment	6.4	5.0	7.8	8.1	7.8	10.0	10.0	10.0
Exports of goods and services	28.0	27.0	25.5	23.6	21.6	19.1	18.5	18.0
Imports of goods and services	30.0	24.5	24.2	24.7	23.6	19.7	19.8	19.9

a Data for 1927-29 differ from those in the D.B.S. publication *National Accounts: Income and Expenditure, 1926-50.*

NOTE: Detail does not always add to total because of rounding.

SOURCE: Appendix D of this chapter.

The broad picture in the record is of a modest growth in the proportion of government expenditure in the total and modest declines in the proportion of consumer expenditure, exports and imports. Investment expenditure is rather more variable and comparisons are therefore more difficult to interpret. The current dollar figures show that the ratio of private fixed investment to G.N.E. rose from an average value of 17.0% in the 1927 to 1929 period to an average value of 18.7% in the years 1950-55. The constant dollar figures on the other hand show the ratio falling from 20% to just over 18%.

The forecasts suggest that the ratio of consumer expenditures to G.N.E. may rise ever so slightly, that the ratios of government and investment expenditure may hold at about their average values for the 1950's, and that the ratios of both exports and imports will continue to fall. Let us comment very briefly on each of the main categories of expenditure.

In the category of consumer expenditures, comparing the late '20's with the 1952 to 1955 period, "the general impression is one of relative stability in the proportions of consumer expenditure devoted to various functions".[4] But while the pattern of consumer expenditures changes slowly there nevertheless have been some changes of note. The proportion of personal expenditure devoted to the purchase and operation of automobiles has risen from some 6% in the period 1926 to 1929 to about 10% over the years 1952 to 1955. Alcoholic beverages, tobacco products, appliances, radio and television equipment, gas and telephone services and drugs and cosmetics also now claim a larger share of the consumer's budget for goods and services than they did in the late '20's. On the other hand the share of expenditures directed to clothing and personal furnishings, shelter, food (especially items other than fresh fruits and vegetables), domestic service and household supplies have declined significantly. For the future the changes anticipated in the study *Consumption Expenditures in Canada* have been summarized as follows:

"It is our view that food, tobacco, clothing, shelter, fuel, household supplies and personal care will account for somewhat smaller fractions of the Canadian budget in the future than they do at the present time. For food, the growth in expenditure at retail levels will be very much faster than the increase in the quantity of food consumed. For most products, the manufactured content is expected to increase. On the other hand, it is our view that the fraction of Canadian personal budgets devoted to the purchase and maintenance of household durables, the purchase and operation of automobiles, medical care, travel and recreational activities, electricity, gas and telephone, and university education will increase."

Within the field of government expenditure on goods and services, a comparison of present-day figures with those for the late 1920's shows a decline

[4] *Consumption Expenditures in Canada*, study prepared for the Royal Commission on Canada's Economic Prospects, Chap. 2.

in the proportion of current non-defence expenditure and a rise in the proportions of investment expenditure and defence expenditure. For the future we have predicted a rise in the ratio to G.N.E. of government current non-defence expenditure above its value in the 1950's but not above values it has attained in peacetime years of fairly full employment. We have also predicted that defence expenditures will decline as a proportion of G.N.E. and that government investment expenditures will remain about the same proportion of G.N.E. as in the 1950 to 1952 period, though at the moment the figure stands somewhat above this. Everyone will realize how particularly tentative and hazardous these predictions of government spending on goods and services must be. The broad assumptions on which they have been based are the following.

Current non-defence expenditures of governments are comprised of their wage and salary bill plus a miscellany of goods and services. Federal government civilian employment is assumed to rise at a rate of about 3% per year; employment by provincial governments is expected, in line with past experience, to rise at some 4% each year. The ratios of municipal employment to population, considered for localities grouped by size, have for three decades been approximately constant and it is assumed that they will remain so. Employment in schools by municipalities has been assumed to rise at the same rate as the number of teachers in primary and secondary education generally. The assumptions underlying this forecast were discussed in Chapter 5. In all these cases it is assumed that the remuneration of the employees will rise at the same rate as output per man-year in the business sector of the economy. Current expenditure on goods and services apart from the wage bill is assumed to rise *pari passu* with government employment.

Non-defence capital expenditures of governments have been forecast as an aggregate in terms of their ratio to G.N.E., with the results noted above. A discussion of the division of outlay among various types of investment is to be found in *Housing and Social Capital,* a study prepared for the Commission. Defence expenditures will rise with the rates of pay of members of the forces (since it has been assumed that the numbers in the forces will remain at the present level) and with the cost of procuring military supplies. It is supposed that service pay will rise at the same rate as civil service pay, namely the rate at which output per man-year increases in the business sector of the economy. But it is expected on the assumption that there will be no major wars, that costs of military supplies will rise at a somewhat slower rate than in the recent past.

We shall not comment at this point on investment expenditure as it has been discussed at some length in the previous chapter. It will be recalled that expenditure on machinery and equipment is expected to become a larger proportion of G.N.E. while outlays on new structures, residential and otherwise, are expected to become a smaller proportion.

Exports have declined and are expected to decline further as a proportion of total expenditure on goods and services. They have declined in relation to fixed investment outlays and government expenditure as well, and this trend too is expected to continue. The commodity composition of our exports has changed and will change, but in the Commission's study on *The Future of Canada's Export Trade* it is forecast that the great preponderance of our exports will continue to be made up of basic primary commodities in their raw or processed form. Wheat and wheat flour have declined in importance and will continue to decline. Lumber, newsprint and wood pulp have grown substantially since the 1920's as have aluminum, iron ore and chemicals. Exports of petroleum and products are expected to show the most dramatic increase; indeed it is forecast that by 1980 they will have replaced newsprint as the largest of our merchandise exports. In 1980, petroleum and products, newsprint, aluminum and products, wood pulp, lumber and iron ore are expected to be our six largest exports and to comprise about half of all merchandise exports. It is also considered likely that the United States will take an even larger share of Canada's exports than she does today.

Imports, like exports, have declined and will continue to decline as a proportion of G.N.E. Imports of services have declined substantially more than imports of merchandise and the most important fact to be adduced in explanation is the sharp fall in interest and dividend payments to non-residents that has occurred. In the Commission's study *Canada's Imports,* in a summary of the factors underlying changes in the pattern of imports, the following generalization is offered: "The most important factor seems to be differences in the rates of growth of Canadian consumption of various products rather than a shift from domestic to foreign sources of supply for particular classes of imports" (Chap. 2).

Imports that have, since the late 1920's, grown as a proportion of total merchandise imports include capital goods, household consumer durables, petroleum and chemicals. On the other hand, some tropical foods and materials, textiles and materials for personal and household furnishing and some staple industrial materials such as rubber, base metals, coal and primary iron and steel have declined as a proportion of total imports. For the future it is predicted that the ratio of non-merchandise imports to the total will be somewhat larger than at present because the increase in tourist items will outweigh some declines in freight and shipping services and a possible long-run decline in interest and dividend payments. Non-merchandise imports will decline as a percentage of G.N.E. sufficiently also to bring down the corresponding ratio for total imports. Among the merchandise imports it is expected that consumer durables, machinery and equipment will continue to increase in importance in line with the trends anticipated in consumer and investment expenditures while imports of fuel, food, clothing and personal furnishings and materials for such items will decline as a proportion

of the total. It seems plausible that the proportion of our imports coming from the United States will increase slightly.

We shall comment in the next part on prospective developments in the difference between exports and imports.

The synopses of the likely developments within each of the main classes of expenditure that we have given in this section are exceedingly brief and unqualified. The reader is urged once again to consult the special studies for details of the analyses underlying the forecasts of each component of expenditure.

V. *Saving and Investment*

Inasmuch as investment expenditures have been studied in Chapter 6, and shown in their relation to G.N.E. in Part IV of the present chapter, we shall concentrate in this part on the components of saving in relation to the total of saving and investment. In another study, *Financing of Economic Activity in Canada,* the record of the financing of capital investment and other forms of expenditure will be considered in some detail, particularly for the postwar period.

The forecasts presented in this part are based on the same general assumptions as those in Part IV, namely, that net immigration will amount to 75 thousand persons per annum and that productivity in the business sector of the economy will increase at a lower annual compound rate of 2½% or a higher rate of 3¼%.

Tables 7. 5 and 7. 6 summarize the record of saving and investment in Canada and present three alternative forecasts for 1980. The summary of the record of saving is based on a more detailed table given in Appendix E to this chapter. The record of investment summarized here is the record published by D.B.S. in their *National Accounts Income and Expenditure* series. It differs somewhat from the record summarized in Table 7. 4 for the period 1926 to 1932. The difference arises because of revisions in the investment series that have not previously been published but which are explained in Chapter 6 and are referred to in Appendix D to this chapter. We are forced here to use the official published series that matches the published saving series, though in due course a revision of the saving and investment account will no doubt be released by D.B.S.

In the saving and investment account shown in Tables 7. 8 and 7. 9 government investment of a non-military character is included with both saving and investment, a practice not followed by the official statistics in Canada. Otherwise the categories shown are the same and defined in the same way as in the National Accounts. Before turning to the substance of this part let us refer to the sources of the forecasts.

Table 7. 5

THE DIVISION OF SAVING

AVERAGES FOR SELECTED YEARS 1926-55; FORECASTS FOR 1979-81

	(billions of current dollars)					1979-81 (billions of 1955 dollars)		
	1927-29	1937-39	1947-49	1950-52	1953-55	Low	Middle	High
Personal saving	.30	.21	.81	1.19	1.29	2.8	3.0	3.2
Undistributed corporation profits	.23	.20	.67	.74	.76	2.2	2.5	2.8
Depreciation allowances and similar business costs	.66	.59	1.28	1.89	2.65	8.4	9.1	9.8
Net bad debt losses of corporations	—.01	—.02	.07	.01	—.02	—	—	—
Total gross business saving	.87	.76	1.88	2.62	3.39	10.6	11.6	12.6
Government receipts less expenditures	.04	—.07	.65	.66	.09	— .1	— .2	— .3
Government non-defence investment expenditure	.16	.17	.50	.80	1.07	2.7	2.9	3.1
Total government saving	.21	.17	1.15	1.46	1.17	2.6	2.7	2.8
Imports less exports of goods and services	+.12	—.13	—.20	+.23	+.51	+ .5	+1.0	+1.5
Error of estimate	—.02	—	.02	.01	—.04	—	—	—
Total saving	1.47	.93	3.66	5.51	6.32	16.5	18.3	20.1
	(percentage)							
Personal saving	20.2	22.2	22.2	21.5	20.4	16.9	16.4	15.9
Undistributed corporation profits	15.7	21.6	18.4	13.5	12.0	13.3	13.7	13.9
Depreciation allowances and similar business costs	44.6	63.5	34.9	34.3	42.0	50.9	49.7	48.7
Net bad debt losses of corporations	—1.1	—3.0	—1.9	.2	— .3	—	—	—
Total gross business saving	59.2	82.1	51.4	47.6	53.7	64.2	63.4	62.7
Government receipts less expenditure	3.2	—8.1	17.9	12.0	1.5	— .6	—1.1	—1.5
Government non-defence investment expenditure	11.0	18.3	13.5	14.5	17.0	16.4	15.9	15.4
Total government saving	14.2	10.2	31.4	26.5	18.5	15.8	14.8	13.9
Imports less exports of goods and services	8.1	—14.6	—5.6	4.1	8.2	3.1	5.5	7.5
Error of estimate	—1.7	.1	.6	.3	—.7	—	—	—

NOTE: Detail does not always add to total because of rounding.
SOURCE: Appendix E of this chapter and D.B.S., *National Accounts: Income and Expenditure.*

Table 7. 6

THE DIVISION OF INVESTMENT

AVERAGES FOR SELECTED YEARS 1926-55; FORECASTS FOR 1979-81

	(billions of current dollars)					*1979-81 (billions of 1955 dollars)*		
	1927-29	1937-39	1947-49	1950-52	1953-55	Low	Middle	High
New residential construction	.23	.17	.63	.79	1.23	2.3	2.6	2.9
New non-residential construction	.40	.18	.77	1.28	1.71	3.5	4.0	4.6
New machinery and equipment	.51	.27	1.19	1.69	1.98	7.0	7.6	8.2
Private fixed investment	1.14	.62	2.59	3,76	4.92	12.8	14.2	15.7
Government non-defence investment expenditure	.16	.17	.50	.80	1.07	2.7	2.9	3.1
Investment in inventories	.14	.14	.59	.96	.28	1.0	1.2	1.3
Error of estimate	+.02	—	—.02	—.01	+.04	—	—	—
Total investment	1.47	.93	3.66	5.51	6.31	16.5	18.3	20.1
	(percentage)							
New residential construction	15.9	18.7	17.2	14.3	19.5	13.9	14.2	14.4
New non-residential construction	27.1	19.0	21.2	23.2	27.1	21.2	21.8	22.9
New machinery and equipment	34.4	29.2	32.5	30.7	31.3	42.4	41.5	40.8
Private fixed investment	77.4	66.9	70.9	68.2	77.9	77.5	77.5	78.1
Government non-defence investment expenditure	11.0	18.3	13.5	14.5	17.0	16.4	15.9	15.4
Investment in inventories	9.9	14.9	16.2	17.5	4.4	6.1	6.5	6.6
Error of estimate	1.7	—.1	—.6	—.2	.7	—	—	—

NOTE: Detail does not always add to total because of rounding.
SOURCE: D.B.S., *National Accounts: Income and Expenditure*.

The forecast of inventory accumulation is based upon an analysis of business inventories and agricultural inventories separately. Study of the statistics available suggested that the ratio of total business inventories to business output (G.D.P.) was fairly constant within periods of full employment, though declining slightly from decade to decade. At slightly below 50% this ratio has fallen about two percentage points from the late 1920's to the average of the postwar period. Continuing improvements in transportation and inventory handling and control methods generally should produce a further fall in the ratio. We assumed it would fall gradually to 45% in 1980. With this assumption and the forecasts of output in the business sector we built up the forecasts of the annual increment in inventories in the business sector. Rather arbitrarily we fixed investment in agricultural inventories at $100 million in 1955 dollars. From 1950 to 1952 it averaged 290 million in current prices, and from 1953 to 1955 it averaged 85 million in current prices.

The forecasts of other classes of investment have been described earlier in this study and in the study of social capital. The forecasts of personal saving and of undistributed corporation profits are described in the study *Consumption Expenditures in Canada.* The forecast of depreciation allowances is described in Chapter 6. It has been assumed that in terms of the accounting practices of governments, there will be no budget surplus for all levels of government in Canada considered together. When the consequences of this assumption are treated according to the accounting conventions used in the National Accounts it turns out that we might expect a small deficit in the combined government account in 1980 the size of which will vary directly with the level of G.N.P. that is forecast. The item is not very large and we shall therefore not go into the technical detail.

In very round numbers, the record shows that on the average from 1953 to 1955, personal saving accounted for about one-fifth and business saving for one-half of total saving, while government saving made up one-fifth and the inflow of capital associated with the deficit in the current account of the balance of payments amounted to nearly one-tenth. Perhaps one of the most striking facts in the record of the distribution of saving is the preponderant role of business saving. This fact is rendered all the more striking when it is recalled that under the present accounting conventions some business saving is in fact concealed in the classification "personal saving". In the period 1927-29 the distribution of saving was much the same as in the later period, save that the share of business saving was even larger while that of government saving was correspondingly lower. The excess of imports over exports was almost precisely the same proportion of total saving in both periods.

In 1980 it seems possible that business saving may be an even larger proportion of the total, perhaps ten percentage points larger. The major change in business saving is expected through increases in depreciation allowances

rather than through undistributed profits. The increase in depreciation allowances is expected to arise from the greater importance of machinery and equipment relative to structures in the stock of capital, since depreciation reserves against machinery and equipment are likely to be built up more rapidly than those against structures.

Such a very large relative increase in depreciation allowances implies a decline in the importance of other forms of saving. Thus it is forecast that personal saving will fall as a proportion of total saving from just over 20% in 1953 to 1955 to just over 16% in 1980. Government saving will fall proportionately by about as many percentage points as personal saving. It is expected that personal saving will be a slightly smaller proportion of personal disposable income in 1980 than it was in 1953 to 1955, but that disposable income will be about the same percentage of G.N.E. as in the earlier period. Consequently personal saving may be a somewhat smaller percentage (and consumer expenditure a somewhat larger percentage) of G.N.E. in 1980. But these changes are small compared with the increase in business saving relative to total saving, and this increase must be regarded as the striking feature of the saving forecasts. Table 7. 7 may help to summarize the relations described in this paragraph.

Table 7. 7

	1953-55	**1980 (middle forecast)**
G.N.E.	\$25.18 billion	\$76.2 billion
Government income less net transfer payments (approximately equal to govt. expenditure on goods and services plus government surplus)	\$ 4.61 billion	\$12.5 billion
Gross business saving	\$ 3.41 billion	\$11.6 billion
Personal disposable income	\$17.2 billion	\$52.1 billion
Personal saving	\$ 1.3 billion	\$ 3.0 billion
Personal expenditure on consumer goods and services	\$15.9 billion	\$49.1 billion
Personal disposable income ÷ G.N.E.	68.4%	68.4%
Personal saving ÷ G.N.E.	5.1%	3.9%
Personal saving ÷ Personal disposable income	7.50%	5.75%
Saving (or investment) ÷ G.N.E.	25.5%	24.0%
Personal saving ÷ Saving	20.4%	16.4%
Business saving ÷ Saving	53.7%	63.4%

An alternative way of viewing government saving is to think of it as being equal to government income from taxes less net transfer payments by governments less government non-investment expenditures. Table 7. 8 illustrates these relationships for 1953 to 1955 and as forecast for 1980.

Table 7. 8

	1953-55		1980	
Government tax income less net transfer payments		4.61		12.5
less government current non-defence expenditures	1.64		6.8	
less government defence expenditures	1.80		3.0	
that is less total government non-investment expenditure		3.44		9.8
equals government saving		1.17		2.7
which in turn is equal to government non-detence investment expenditure		1.07		2.9
plus the government surplus or less the government deficit except for errors of rounding		+ .09		— .2

The difference between exports and imports is relatively small and correspondingly difficult to forecast. A very small proportionate difference in the forecast of either exports or imports makes a very significant proportionate difference in the forecast of the balance of exports and imports. It must therefore be emphasized that the forecast of this balance is much more liable to error than the forecast of some other items in the saving and investment account. It is felt however that whether the balance shows exports less than or greater than imports by 1980, contributions of foreign saving shown in this form will be a smaller proportion of total Canadian saving than at the present time. Probably a generation from now the current account of the balance of payments will in some years show a deficit and in some years a surplus; the forecast shown above should be interpreted as implying that a relatively small deficit will be more common than a surplus. Of course foreign contributions to domestic saving arise also from the retained earnings and depreciation allowances of foreign-owned concerns operating in Canada and these are offset to some extent by similar investments of Canadian-owned concerns abroad. But into these matters we must not enter; they are discussed particularly in the Commission's study *Canada-United States Economic Relations.*

VI. *Summary and Concluding Observations*

To undertake a very brief summary of forecasts is perhaps even more incautious than forecasting itself. But it may be helpful to observe that our forecasts do not indicate revolutionary changes in the industrial distribution of output and employment or in the broad distribution of national expenditure, saving and investment. The Canadian economy will continue to be oriented toward the exploitation of the natural resources with which it is so richly endowed. About a fifth of its output will continue to be produced in resource industries and agriculture. Another two-fifths will continue to

be produced in the service, transportation and government sectors. Since about two-thirds of expenditure will be directed to consumer goods and services for many decades, there will be little change in the proportion of expenditure devoted to investment, and a very substantial proportion of investment will be financed out of the savings of Canadians. There will be changes, though most of these will be the continuation of changes we have already witnessed. The absolute decline in employment in agriculture and the relative decline in agricultural output will persist though perhaps at a somewhat diminishing rate. The service or tertiary industries, defined broadly, will continue to experience the main relative expansion of employment. The increasing relative importance of the demand for durable goods by householders and for machinery and equipment by industry will be reflected in the growth of output and of productivity in secondary industry, the increased concentration of our imports on "hard goods", and the growing relative importance of business saving (through depreciation allowances) in total saving. Our imports and exports will decline in relation to G.N.E. as will, it seems most likely, our deficit on international current account. The composition of our exports will change, but the changes we expect are heralded in the figures already in the record showing the rise of newer primary products and the relative decline of more traditional exports such as wheat and flour.

But it must not be assumed that the paths from the present to the future as visualized in our forecasts for 1980 will be smooth and uninterrupted (as perhaps the diagrams in this chapter may have suggested). We have discussed, especially in Chapters 2 and 3, the view that growth in a capitalist economy is uneven, with periods of bunched investment and invention succeeded by periods of retrenchment and marginal application of new ideas. We expressed the view there and we repeat it here that the business cycle will continue to affect the levels of economic activity even though it may be kept within somewhat better control than in earlier days if present knowledge of anti-cyclical policies is developed, refined and applied.

It has not been our intention however, as we stated in Part IV of Chapter 3 to forecast the cyclical path of Canadian economic growth. It would be even more difficult to come to a firm view as to the paths the economic aggregates are likely actually to trace than it has been to come to a view concerning the positions of the lines passing through the peaks of the cyclical paths. We shall mention two broad groups of forces that will have different degrees of impact on the economy at different periods within the next 25 years. We do not express an opinion as to whether the forces in question will dominate the scene at any particular time nor do we contend these are necessarily the most important ones to study in seeking to forecast the actual performance of the economy in any particular year or years in the next 25.

Both the forces to which we wish to refer are related to the often observed phenomenon that a pattern of increments to a stock foreshadows future developments and requirements. In particular the course of Canada's population growth in the last generation will play an important part in determining the growth and economic needs of the population over the next generation and secondly, the past uneven growth of the stock of capital leads to a presumption that its replacement may not be spread evenly in the future.

The juvenile population under 20 is expected to grow most rapidly in the first decade of the forecast period, a little less rapidly in the second decade and then rather more rapidly again in the last quinquennium. The implications of this for investment in school buildings and houses to accommodate somewhat larger families, to mention but two, have been considered in the Commission's study of *Housing and Social Capital*. The population over 60 is expected steadily to increase as a proportion of the total population and this development will induce an accelerating growth in the goods and services required by older people. The increase in net family formation is expected to be lowest in the first quinquennium of the forecast period and to reach its maximum around 1975. This of course has direct implications for the distribution over the forecast period of the demand for housing and for the consumer durables and other items needed by new families.

The replacement of capital has been referred to earlier in this study, especially in Chapter 6. Our calculations of future investment expenditure suggest that some of the bursts of investment activity in the past "cast their shadow before them", indicating rather flattened but nevertheless visible bursts of replacement investment in the future. It would, of course, be foolish to predict that previous periods of intense investment are exactly duplicated L years later, since houses, buildings and equipment do not have precise service lives after which they are unusable. The shadow of a boom in investment cast over many years and centred perhaps on the dates at which the average lifetimes of each class of asset have been spent is dissipated by the possibilities of maintenance and repair, and alternative uses, combined with the effect of current economic conditions generally.

The replacement demand for housing we expect to be most intense in the second and fifth quinquennia of the forecast period. But we have to be cautious for it has been shown that repair and maintenance render it possible for houses to be kept in usable condition for many years beyond their expected service lives. Probably alternative uses of the land on which housing is located are more important in decisions about scrapping and replacing houses than are considerations of wear and tear, high maintenance costs or general obsolescence.

The underlying retardation in the demand for non-residential construction is likely to be nearly offset until 1970 by replacement demand. For the

last decade of the forecast period however, replacement demand is expected to be significantly smaller and in this period total investment expenditure on non-residential structures will therefore show a rather slower rate of growth than the average for the 25 years.

The cycle of replacement expenditures on machinery and equipment may be expected to reach its trough in about the same period as that for non-residential construction, namely the last decade of the forecast period. But it is impossible to make very specific predictions since the wide range in the service lives of different types of machinery and the ease with which machines can be either maintained or repaired for long life or replaced in anticipation of expected scrapping means that expected replacement cycles will inevitably be flattened out by market and random forces.

We cannot pursue these matters further here. There are other obvious lines of implication as for example for machinery, other imports, business saving through depreciation allowances, the current international balance, and personal income, expenditure and employment. Though forecasting actual developments over the short run has not been our responsibility we have formed the opinion that if it were, replacement cycles in demand for durable assets by households and by business and the implications for particular markets of changes in the structure of the population would repay detailed study.

Our responsibility has been to forecast the growth of output and employment and the accumulation of capital over the coming 25 years. We have argued that the future will not represent a sharp break with the past and that the changes we can anticipate are the extensions of those already in our view. In view of the gains already enjoyed over the last generation, and the fact that by and large the future appears as a continuing evolution from the past, it is difficult not to be enthusiastic about the economic prospects of rising standards of living for the next generation of Canadians.

APPENDICES

APPENDICES — CHAPTER 4

Chapter 4, Appendix A

ESTIMATES OF THE FUTURE POPULATION OF CANADA

In the following tables estimates of the population of Canada (Yukon and Northwest Territories excluded) are presented by age and sex as at June 1 for 1960, 1965, 1970, 1975 and 1980. Four sets of estimates are given on the basis of four separate assumptions as to the (constant) rate of net immigration throughout the period. In the tables percentage distributions do not always add to 100 because of rounding.

Table 4A. 1

ESTIMATED POPULATION OF CANADA

(net immigration—0 per annum)

1960

Age	Male		Female		Total	
	000	%	000	%	000	%
0–4	1,047.5	12.1	999.3	11.8	2,046.8	12.0
5–9	998.5	11.6	958.0	11.3	1,956.5	11.5
10–14......	856.4	9.9	819.6	9.7	1,676.0	9.8
15–19......	686.8	8.0	661.5	7.8	1,348.3	7.9
20–24......	571.2	6.6	552.1	6.5	1,123.3	6.6
25–29......	554.5	6.4	546.3	6.5	1,100.8	6.4
30–34......	588.0	6.8	594.3	7.0	1,182.3	6.9
35–39......	557.8	6.5	577.0	6.8	1,134.8	6.6
40–44......	534.2	6.2	540.2	6.4	1,074.4	6.3
45–49......	490.3	5.7	480.8	5.7	971.1	5.7
50–54......	422.9	4.9	400.2	4.7	823.1	4.8
55–59......	354.8	4.1	339.3	4.0	694.1	4.1
60–64......	290.8	3.4	292.2	3.5	583.0	3.4
65–69......	234.7	2.7	240.6	2.8	475.3	2.8
70–74......	193.4	2.2	194.1	2.3	387.5	2.3
75–79......	137.4	1.6	141.7	1.7	279.1	1.6
80–84......	73.5	.9	80.8	1.0	154.3	.9
85–89......	27.2	.3	32.4	.4	59.6	.3
90+	6.7	.1	10.3	.1	17.0	.1
Total	8,626.6	100.0	8,460.7	100.0	17,087.3	100.0

Table 4A. 1 (Cont'd.)

ESTIMATED POPULATION OF CANADA

(net immigration—0 per annum)

1965

	Male		Female		Total	
	000	%	000	%	000	%
0–4	1,065.2	11.4	1,015.0	11.0	2,080.2	11.2
5–9	1,044.3	11.1	996.7	10.8	2,041.0	11.0
10–14	995.4	10.6	956.0	10.4	1,951.4	10.5
15–19	853.9	9.1	818.2	8.9	1,672.1	9.0
20–24	683.1	7.3	659.9	7.2	1,343.0	7.2
25–29	568.1	6.1	550.4	6.0	1,118.5	6.0
30–34	550.2	5.9	544.4	5.9	1,094.6	5.9
35–39	583.5	6.2	591.7	6.4	1,175.2	6.3
40–44	552.0	5.9	573.9	6.2	1,125.9	6.1
45–49	525.1	5.6	534.5	5.8	1,059.6	5.7
50–54	475.3	5.1	472.1	5.1	947.4	5.1
55–59	405.9	4.3	388.8	4.2	794.7	4.3
60–64	328.3	3.5	325.1	3.5	653.4	3.5
65–69	257.1	2.7	272.3	3.0	529.4	2.8
70–74	197.4	2.1	214.7	2.3	412.1	2.2
75–79	148.7	1.6	159.3	1.7	308.0	1.7
80–84	91.8	1.0	101.8	1.1	193.6	1.0
85–89	37.7	.4	44.4	.5	82.1	.4
90+	9.8	.1	14.4	.2	24.2	.1
Total	9,372.8	100.0	9,233.6	100.0	18,606.4	100.0

1970

Age	Male		Female		Total	
	000	%	000	%	000	%
0–4	1,128.4	11.1	1,073.6	10.7	2,202.0	10.9
5–9	1,062.6	10.5	1,013.2	10.1	2,075.8	10.3
10–14	1,041.4	10.2	995.1	9.9	2,036.5	10.1
15–19	993.0	9.8	954.8	9.5	1,947.8	9.6
20–24	849.8	8.4	816.7	8.1	1,666.5	8.3
25–29	679.1	6.7	658.4	6.6	1,337.5	6.6
30–34	565.0	5.6	548.9	5.5	1,113.9	5.5
35–39	547.2	5.4	542.6	5.4	1,089.8	5.4
40–44	578.2	5.7	588.5	5.9	1,166.7	5.8
45–49	543.2	5.3	563.1	5.6	1,106.3	5.5
50–54	509.9	5.0	525.9	5.2	1,035.8	5.1
55–59	452.9	4.5	459.8	4.6	912.7	4.5
60–64	375.8	3.7	373.7	3.7	749.5	3.7
65–69	290.6	2.9	304.2	3.0	594.8	2.9
70–74	217.4	2.1	244.8	2.4	462.2	2.3
75–79	153.1	1.5	177.9	1.8	331.0	1.6
80–84	101.2	1.0	116.3	1.2	217.5	1.1
85–89	48.4	.5	57.2	.6	105.6	.5
90+	14.2	.1	20.3	.2	34.5	.2
Total	10,151.4	100.0	10,035.0	100.0	20,186.4	100.0

Table 4A. 1 (Concluded)

ESTIMATED POPULATION OF CANADA

(net immigration—0 per annum)

1975

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,254.1	11.4	1,191.5	10.9	2,445.6	11.1
5–9	1,126.4	10.2	1,072.2	9.8	2,198.6	10.0
10–14......	1,060.2	9.6	1,011.9	9.3	2,072.1	9.4
15–19......	1,039.3	9.4	994.2	9.1	2,033.5	9.3
20–24......	988.9	9.0	953.5	8.7	1,942.4	8.8
25–29......	845.6	7.7	815.3	7.5	1,660.9	7.6
30–34......	675.1	6.1	657.1	6.0	1,332.2	6.1
35–39......	561.7	5.1	547.5	5.0	1,109.2	5.1
40–44......	542.8	4.9	540.3	4.9	1,083.1	4.9
45–49......	569.9	5.2	584.1	5.3	1,154.0	5.3
50–54......	528.1	4.8	555.0	5.1	1,083.1	4.9
55–59......	486.4	4.4	512.9	4.7	999.3	4.6
60–64......	419.5	3.8	443.3	4.1	862.8	3.9
65–69......	332.8	3.0	351.3	3.2	684.1	3.1
70–74......	245.2	2.2	275.5	2.5	520.7	2.4
75–79......	170.0	1.5	204.9	1.9	374.9	1.7
80–84......	105.9	1.0	131.3	1.2	237.2	1.1
85–89......	54.3	.5	66.4	.6	120.7	.6
90+	19.2	.2	27.3	.3	46.5	.2
Total	11,025.4	100.0	10,935.5	100.0	21,960.9	100.0

1980

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,420.4	11.8	1,348.3	11.3	2,768.7	11.5
5–9	1,252.5	10.4	1,190.4	9.9	2,442.9	10.2
10–14......	1,124.3	9.3	1,071.2	8.9	2,195.5	9.1
15–19......	1,058.5	8.8	1,011.1	8.5	2,069.6	8.6
20–24......	1,035.6	8.6	993.2	8.3	2,028.8	8.5
25–29......	984.7	8.2	952.3	8.0	1,937.0	8.1
30–34......	841.3	7.0	814.1	6.8	1,655.4	6.9
35–39......	671.7	5.6	655.9	5.5	1,327.6	5.5
40–44......	557.8	4.6	545.6	4.6	1,103.4	4.6
45–49......	535.3	4.5	536.9	4.5	1,072.2	4.5
50–54......	554.5	4.6	576.5	4.8	1,131.0	4.7
55–59......	504.3	4.2	542.8	4.5	1,047.1	4.4
60–64......	450.7	3.7	495.9	4.1	946.6	3.9
65–69......	371.7	3.1	418.4	3.5	790.1	3.3
70–74......	283.3	2.4	320.1	2.7	603.4	2.5
75–79......	192.7	1.6	232.5	1.9	425.2	1.8
80–84......	118.9	1.0	154.3	1.3	273.2	1.1
85–89......	58.6	.5	76.2	.6	134.8	.6
90+	22.7	.2	33.4	.3	56.1	.2
Total	12,039.5	100.0	11,969.1	100.0	24,008.6	100.0

Table 4A. 2

ESTIMATED POPULATION OF CANADA

(net immigration—50,000 per annum)

1960

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,064.3	12.1	1,015.3	11.8	2,079.6	12.0
5–9	1,009.5	11.5	968.2	11.3	1,977.7	11.4
10–14......	867.4	9.9	829.3	9.7	1,696.7	9.8
15–19......	693.8	7.9	667.3	7.8	1,361.1	7.8
20–24......	581.9	6.6	560.1	6.5	1,142.0	6.6
25–29......	580.0	6.6	565.5	6.6	1,145.5	6.6
30–34......	614.3	7.0	613.4	7.1	1,227.7	7.1
35–39......	570.2	6.5	588.8	6.9	1,159.0	6.7
40–44......	549.2	6.3	549.8	6.4	1,099.0	6.3
45–49......	497.5	5.7	485.8	5.7	983.3	5.7
50–54......	428.3	4.9	405.7	4.7	834.0	4.8
55–59......	356.7	4.1	341.4	4.0	698.1	4.0
60–64......	292.7	3.3	292.8	3.4	585.5	3.4
65–69......	236.3	2.7	243.6	2.8	479.9	2.8
70–74......	193.4	2.2	194.1	2.3	387.5	2.2
75–79......	137.4	1.6	141.7	1.7	279.1	1.6
80–84......	73.5	.8	80.8	.9	154.3	.9
85–89......	27.2	.3	32.4	.4	59.6	.3
90+	6.7	.1	10.3	.1	17.0	.1
Total	8,780.3	100.0	8,586.3	100.0	17,366.6	100.0

1965

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,107.7	11.4	1,055.5	11.1	2,163.2	11.3
5–9	1,072.1	11.1	1,022.9	10.7	2,095.0	10.9
10–14......	1,017.4	10.5	975.9	10.3	1,993.3	10.4
15–19......	871.9	9.0	833.6	8.7	1,705.5	8.9
20–24......	700.7	7.2	673.7	7.1	1,374.4	7.2
25–29......	604.2	6.2	577.6	6.1	1,181.8	6.2
30–34......	601.8	6.2	582.6	6.1	1,184.4	6.2
35–39......	621.9	6.4	622.5	6.5	1,244.4	6.5
40–44......	579.2	6.0	595.2	6.2	1,174.4	6.1
45–49......	546.9	5.6	548.9	5.8	1,095.8	5.7
50–54......	487.7	5.0	482.5	5.1	970.2	5.0
55–59......	412.8	4.3	396.2	4.2	809.0	4.2
60–64......	331.9	3.4	329.7	3.5	661.6	3.4
65–69......	260.2	2.7	277.8	2.9	538.0	2.8
70–74......	198.7	2.1	217.4	2.3	416.1	2.2
75–79......	148.7	1.5	159.3	1.7	308.0	1.6
80–84......	91.8	.9	101.8	1.1	193.6	1.0
85–89......	37.7	.4	44.4	.5	82.1	.4
90+	9.8	.1	14.4	.1	24.2	.1
Total	9,703.1	100.0	9,510.9	100.0	19,215.0	100.0

Table 4A. 2 (Cont'd.)

ESTIMATED POPULATION OF CANADA

(net immigration—50,000 per annum)

1970

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,191.3	11.2	1,133.4	10.8	2,324.7	11.0
5–9	1,116.0	10.4	1,063.8	10.2	2,179.8	10.3
10–14......	1,080.0	10.1	1,030.9	9.8	2,110.9	10.0
15–19......	1,021.9	9.6	980.4	9.4	2,002.3	9.5
20–24......	878.4	8.2	840.1	8.0	1,718.5	8.1
25–29......	722.1	6.8	691.3	6.6	1,413.4	6.7
30–34......	627.3	5.9	595.1	5.7	1,222.4	5.8
35–39......	610.8	5.7	592.5	5.6	1,203.3	5.7
40–44......	631.2	5.9	628.7	6.0	1,259.9	6.0
45–49......	577.2	5.4	589.3	5.6	1,166.5	5.5
50–54......	536.5	5.0	545.6	5.2	1,082.1	5.1
55–59......	466.5	4.4	472.6	4.5	939.1	4.4
60–64......	384.0	3.6	383.5	3.7	767.5	3.6
65–69......	295.2	2.8	311.6	3.0	606.8	2.9
70–74......	220.0	2.1	249.8	2.4	469.8	2.2
75–79......	154.1	1.4	180.1	1.7	334.2	1.6
80–84......	101.2	.9	116.3	1.1	217.5	1.0
85–89......	48.4	.5	57.2	.5	105.6	.5
90+	14.2	.1	20.3	.2	34.5	.2
Total	10,676.3	100.0	10,482.5	100.0	21,158.8	100.0

1975

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,333.0	11.3	1,266.3	11.0	2,599.3	11.2
5–9	1,200.2	10.2	1,142.2	9.9	2,342.4	10.1
10–14......	1,124.4	9.6	1,072.1	9.3	2,196.5	9.4
15–19......	1,084.9	9.2	1,035.8	9.0	2,120.7	9.1
20–24......	1,028.5	8.8	987.1	8.5	2,015.6	8.7
25–29......	899.6	7.6	857.8	7.4	1,757.4	7.5
30–34......	744.3	6.3	709.1	6.1	1,453.4	6.2
35–39......	635.9	5.4	605.5	5.2	1,241.4	5.3
40–44......	621.0	5.3	592.9	5.1	1,213.9	5.2
45–49......	629.3	5.3	528.9	5.4	1,258.2	5.4
50–54......	566.5	4.8	586.2	5.1	1,152.7	4.9
55–59......	513.6	4.4	534.3	4.6	1,047.9	4.5
60–64......	434.0	3.7	457.7	4.0	891.7	3.8
65–69......	341.6	2.9	362.2	3.1	703.8	3.0
70–74......	249.2	2.1	282.2	2.4	531.4	2.3
75–79......	172.0	1.5	209.1	1.8	381.1	1.6
80–84......	106.6	.9	133.0	1.5	239.6	1.0
85–89......	54.3	.5	66.4	.6	120.7	.5
90+	19.2	.2	27.3	.2	46.5	.2
Total	11,758.1	100.0	11,556.1	100.0	23,314.2	100.0

Table 4A. 2 (Concluded)

ESTIMATED POPULATION OF CANADA

(net immigration—50,000 per annum)

1980

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,514.6	11.7	1,437.7	11.2	2,952.3	11.5
5–9	1,342.2	10.3	1,275.4	10.0	2,617.6	10.2
10–14......	1,209.0	9.3	1,150.8	9.0	2,359.8	9.2
15–19......	1,120.8	8.6	1,077.1	8.4	2,197.9	8.5
20–24......	1,091.8	8.4	1,042.8	8.2	2,134.6	8.3
25–29......	1,049.5	8.1	1,005.0	7.9	2,054.5	8.0
30–34......	921.3	7.1	875.7	6.8	1,797.0	7.0
35–39......	752.9	5.8	719.5	5.6	1,472.4	5.7
40–44......	646.6	5.0	612.8	4.8	1,259.4	4.9
45–49......	619.7	4.8	600.8	4.7	1,220.5	4.7
50–54......	617.7	4.8	626.3	4.9	1,244.0	4.8
55–59......	542.8	4.2	575.5	4.5	1,118.3	4.3
60–64......	477.8	3.7	519.2	4.0	997.0	3.9
65–69......	386.0	3.0	435.1	3.4	821.1	3.2
70–74......	290.9	2.2	331.2	2.6	622.1	2.4
75–79......	195.8	1.5	238.2	1.9	434.0	1.7
80–84......	120.4	.9	157.5	1.2	277.9	1.1
85–89......	59.0	.5	77.6	.6	136.6	.5
90+	22.7	.2	33.4	.3	56.1	.2
Total	12,981.5	100.0	12,791.6	100.0	25,773.1	100.0

Table 4A. 3

ESTIMATED POPULATION OF CANADA

(net immigration—75,000 per annum)

1960

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,072.7	12.1	1,023.3	11.8	2,096.0	12.0
5–9	1,014.9	11.5	973.3	11.2	1,988.2	11.3
10–14......	872.9	9.8	834.1	9.6	1,707.0	9.7
15–19......	697.3	7.9	670.1	7.8	1,367.4	7.8
20–24......	587.2	6.6	564.1	6.5	1,151.3	6.6
25–29......	592.7	6.7	575.1	6.7	1,167.8	6.7
30–34......	627.4	7.1	622.9	7.2	1,250.3	7.1
35–39......	576.3	6.5	594.7	6.9	1,171.0	6.7
40–44......	556.7	6.3	554.5	6.4	1,111.2	6.3
45–49......	501.1	5.7	488.3	5.6	989.4	5.7
50–54......	431.0	4.9	408.4	4.7	839.4	4.8
55–59......	357.6	4.0	342.4	4.0	700.0	4.0
60–64......	293.6	3.3	296.1	3.4	589.7	3.4
65–69......	237.0	2.7	245.1	2.8	482.1	2.8
70–74......	193.4	2.2	194.1	2.2	387.5	2.2
75–79......	137.4	1.6	141.7	1.6	279.1	1.6
80–84......	73.5	.8	80.8	.9	154.3	.9
85–89......	27.2	.3	32.4	.4	59.6	.3
90+	6.7	.1	10.3	.1	17.0	.1
Total	8,856.6	100.0	8,651.7	100.0	17,508.3	100.0

1965

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,128.9	11.4	1,075.7	11.1	2,204.6	11.3
5–9	1,085.9	11.0	1,036.0	10.7	2,121.9	10.9
10–14......	1,028.3	10.4	985.8	10.2	2,014.1	10.3
15–19......	880.8	8.9	841.3	8.7	1,722.1	8.8
20–24......	709.5	7.2	680.5	7.0	1,390.0	7.1
25–29......	622.2	6.3	591.1	6.1	1,213.3	6.2
30–34......	627.5	6.4	601.7	6.2	1,229.2	6.3
35–39......	641.0	6.5	637.9	6.6	1,278.9	6.6
40–44......	592.7	6.0	605.8	6.3	1,198.5	6.1
45–49......	557.7	5.7	556.1	5.8	1,113.8	5.7
50–54......	493.8	5.0	487.7	5.1	981.5	5.0
55–59......	416.2	4.2	399.9	4.1	816.1	4.2
60–64......	333.6	3.4	332.0	3.4	665.6	3.4
65–69......	261.7	2.7	280.5	2.9	542.2	2.8
70–74......	199.3	2.0	218.7	2.3	418.0	2.1
75–79......	148.7	1.5	159.3	1.7	308.0	1.6
80–84......	91.8	.9	101.8	1.1	193.6	1.0
85–89......	37.7	.4	44.4	.5	82.1	.4
90+	9.8	.1	14.4	.2	24.2	.1
Total	9,867.1	100.0	9,650.6	100.0	19,517.7	100.0

Table 4A. 3 (Cont'd.)

ESTIMATED POPULATION OF CANADA

(net immigration—75,000 per annum)

1970

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,222.7	11.2	1,163.3	10.9	2,386.0	11.0
5–9	1,142.6	10.5	1,089.0	10.2	2,231.6	10.3
10–14......	1,099.3	10.1	1,048.8	9.8	2,148.1	9.9
15–19......	1,036.3	9.5	993.2	9.3	2,029.5	9.4
20–24......	892.6	8.2	851.7	8.0	1,744.3	8.1
25–29......	743.6	6.8	707.7	6.6	1,451.3	6.7
30–34......	658.4	6.0	618.1	5.8	1,276.5	5.9
35–39......	642.6	5.9	617.4	5.8	1,260.0	5.8
40–44......	657.7	6.0	648.7	6.1	1,306.4	6.0
45–49......	594.1	5.4	602.3	5.6	1,196.4	5.5
50–54......	549.7	5.0	555.4	5.2	1,105.1	5.1
55–59......	473.3	4.3	478.2	4.5	951.5	4.4
60–64......	388.1	3.6	388.3	3.6	776.4	3.6
65–69......	297.5	2.7	315.2	2.9	612.7	2.8
70–74......	221.3	2.0	252.2	2.4	473.5	2.2
75–79......	154.6	1.4	181.2	1.7	335.8	1.6
80–84......	101.2	.9	116.3	1.1	217.5	1.0
85–89......	48.4	.4	57.2	.5	105.6	.5
90+	14.2	.1	20.3	.2	34.5	.2
Total	10,938.2	100.0	10,704.5	100.0	21,642.7	100.0

1975

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,372.4	11.3	1,303.7	11.0	2,676.1	11.2
5–9	1,237.0	10.2	1,177.1	9.9	2,414.1	10.1
10–14......	1,156.4	9.5	1,102.2	9.3	2,258.6	9.4
15–19......	1,107.6	9.1	1,056.5	8.9	2,164.1	9.0
20–24......	1,048.2	8.7	1,003.8	8.5	2,052.0	8.5
25–29......	926.5	7.6	879.0	7.4	1,805.5	7.5
30–34......	778.8	6.4	735.0	6.2	1,513.8	6.3
35–39......	673.0	5.6	634.4	5.3	1,307.4	5.5
40–44......	660.1	5.4	619.1	5.2	1,279.2	5.3
45–49......	659.0	5.4	651.4	5.5	1,310.4	5.5
50–54......	585.7	4.8	601.7	5.1	1,187.4	4.9
55–59......	527.1	4.3	544.9	4.6	1,072.0	4.5
60–64......	441.2	3.6	464.9	3.9	906.1	3.8
65–69......	345.9	2.9	367.6	3.1	713.5	3.0
70–74......	251.1	2.1	285.5	2.4	536.6	2.2
75–79......	173.0	1.4	211.1	1.8	384.1	1.6
80–84......	106.9	.9	133.8	1.1	240.7	1.0
85–89......	54.3	.5	66.4	.6	120.7	.5
90+	19.2	.2	27.3	.2	46.5	.2
Total	12,123.4	100.0	11,865.4	100.0	23,988.8	100.0

Table 4A. 3 (Concluded)

ESTIMATED POPULATION OF CANADA

(net immigration—75,000 per annum)

1980

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,561.6	11.6	1,482.4	11.2	3,044.0	11.4
5–9	1,387.0	10.3	1,317.9	10.0	2,704.9	10.2
10–14......	1,251.3	9.3	1,190.6	9.0	2,441.9	9.2
15–19......	1,152.1	8.6	1,110.0	8.4	2,262.1	8.5
20–24......	1,119.8	8.3	1,067.5	8.1	2,187.3	8.2
25–29......	1,081.9	8.0	1,031.3	7.8	2,113.2	7.9
30–34......	961.3	7.2	906.5	6.9	1,867.8	7.0
35–39......	793.4	5.9	751.3	5.7	1,544.7	5.8
40–44......	691.0	5.1	646.4	4.9	1,337.4	5.0
45–49......	661.8	4.9	632.7	4.8	1,294.5	4.9
50–54......	649.4	4.8	651.2	4.9	1,300.6	4.9
55–59......	562.0	4.2	591.8	4.5	1,153.8	4.3
60–64......	491.3	3.7	530.8	4.0	1,022.1	3.8
65–69......	393.1	2.9	443.4	3.4	836.5	3.1
70–74......	294.6	2.2	336.7	2.5	631.3	2.4
75–79......	197.3	1.5	241.0	1.8	438.3	1.6
80–84......	121.1	.9	159.0	1.2	280.1	1.1
85–89......	59.2	.4	77.6	.6	136.8	.5
90+	22.7	.2	33.4	.3	56.1	.2
Total	13,451.9	100.0	13,201.5	100.0	26,653.4	100.0

Table 4A. 4

ESTIMATED POPULATION OF CANADA

(net immigration—100,000 per annum)

1960

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,081.1	12.1	1,031.3	11.8	2,112.4	12.0
5–9	1,020.4	11.4	978.4	11.2	1,998.8	11.3
10–14......	878.4	9.8	838.9	9.6	1,717.3	9.7
15–19......	700.8	7.8	673.0	7.7	1,373.8	7.8
20–24......	592.5	6.6	568.1	6.5	1,160.6	6.6
25–29......	605.4	6.8	584.7	6.7	1,190.1	6.7
30–34......	640.5	7.2	632.4	7.3	1,272.9	7.2
35–39......	582.5	6.5	600.6	6.9	1,183.1	6.7
40–44......	564.2	6.3	559.3	6.4	1,123.5	6.4
45–49......	504.7	5.7	490.8	5.6	995.5	5.6
50–54......	433.7	4.9	411.1	4.7	844.8	4.8
55–59......	358.5	4.0	343.3	3.9	701.8	4.0
60–64......	294.5	3.3	297.4	3.4	591.9	3.4
65–69......	237.8	2.7	246.6	2.8	484.4	2.7
70–74......	193.4	2.2	194.1	2.2	387.5	2.2
75–79......	137.4	1.5	141.7	1.6	279.1	1.6
80–84......	73.5	.8	80.8	.9	154.3	.9
85–89......	27.2	.3	32.4	.4	59.6	.3
90+	6.7	.1	10.3	.1	17.0	.1
Total	8,933.2	100.0	8,715.2	100.0	17,648.4	100.0

1965

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,150.1	11.5	1,095.9	11.2	2,246.0	11.3
5–9	1,099.8	11.0	1,049.1	10.7	2,148.9	10.8
10–14......	1,039.3	10.4	995.7	10.2	2,035.0	10.3
15–19......	889.8	8.9	849.0	8.7	1,738.8	8.8
20–24......	718.3	7.2	687.4	7.0	1,405.7	7.1
25–29......	640.2	6.4	604.7	6.2	1,244.9	6.3
30–34......	653.3	6.5	620.8	6.3	1,274.1	6.4
35–39......	660.2	6.6	653.3	6.7	1,313.5	6.6
40–44......	606.3	6.0	616.4	6.3	1,222.7	6.2
45–49......	568.6	5.7	563.3	5.8	1,131.9	5.7
50–54......	500.0	5.0	492.9	5.0	992.9	5.0
55–59......	419.6	4.2	403.6	4.1	823.2	4.1
60–64......	335.4	3.3	334.3	3.4	669.7	3.4
65–69......	263.2	2.6	283.2	2.9	546.4	2.8
70–74......	199.9	2.0	220.0	2.2	419.9	2.1
75–79......	148.7	1.5	159.3	1.6	308.0	1.6
80–84......	91.8	.9	101.8	1.0	193.6	1.0
85–89......	37.7	.4	44.4	.5	82.1	.4
90+	9.8	.1	14.4	.1	24.2	.1
Total	10,032.0	100.0	9,789.5	100.0	19,821.5	100.0

Table 4A. 4 (Continued)

ESTIMATED POPULATION OF CANADA

(net immigration—100,000 per annum)

1970

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,254.1	11.2	1,193.2	10.9	2,447.3	11.0
5–9	1,169.3	10.4	1,114.3	10.2	2,283.6	10.3
10–14......	1,118.6	10.0	1,066.7	9.8	2,185.3	9.9
15–19......	1,050.7	9.4	1,006.0	9.2	2,056.7	9.3
20–24......	906.9	8.1	863.4	7.9	1,770.3	8.0
25–29......	765.1	6.8	724.1	6.6	1,489.2	6.7
30–34......	689.5	6.2	641.2	5.9	1,330.7	6.0
35–39......	674.4	6.0	642.3	5.9	1,316.7	6.0
40–44......	684.2	6.1	668.8	6.1	1,353.0	6.1
45–49......	611.1	5.5	615.4	5.6	1,226.5	5.5
50–54......	563.0	5.0	565.2	5.2	1,128.2	5.1
55–59......	480.1	4.3	484.3	4.4	964.4	4.4
60–64......	392.2	3.5	393.2	3.6	785.4	3.5
65–69......	299.8	2.7	318.9	2.9	618.7	2.8
70–74......	222.6	2.0	254.7	2.3	477.3	2.2
75–79......	155.1	1.4	182.3	1.7	337.4	1.5
80–84......	101.2	.9	116.3	1.1	217.5	1.0
85–89......	48.4	.4	57.2	.5	105.6	.5
90+	14.2	.1	20.3	.2	34.5	.2
Total	11,200.5	100.0	10,927.8	100.0	22,128.3	100.0

1975

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,411.8	11.3	1,341.1	11.0	2,752.9	11.2
5–9	1,273.9	10.2	1,212.1	10.0	2,486.0	10.0
10–14......	1,188.5	9.5	1,132.3	9.3	2,320.8	9.4
15–19......	1,130.4	9.1	1,077.3	8.8	2,207.7	9.0
20–24......	1,068.0	8.6	1,020.6	8.3	2,088.6	8.5
25–29......	953.5	7.6	900.2	7.4	1,853.7	7.5
30–34......	813.4	6.5	761.0	6.3	1,574.4	6.4
35–39......	710.1	5.7	663.4	5.4	1,373.5	5.6
40–44......	699.2	5.6	645.4	5.3	1,344.6	5.4
45–49......	688.7	5.5	673.8	5.5	1,362.5	5.5
50–54......	604.9	4.8	617.3	5.1	1,222.2	5.0
55–59......	540.7	4.3	555.6	4.6	1,096.3	4.4
60–64......	448.4	3.6	472.1	3.9	920.5	3.7
65–69......	350.3	2.8	373.0	3.1	723.3	2.9
70–74......	253.1	2.0	288.8	2.4	541.9	2.2
75–79......	174.0	1.4	213.2	1.8	387.2	1.6
80–84......	107.2	.9	134.6	1.1	241.8	1.0
85–89......	54.3	.4	66.4	.5	120.7	.5
90+	19.2	.2	27.3	.2	46.5	.2
Total	12,489.6	100.0	12,175.5	100.0	24,665.1	100.0

Table 4A. 4 (Concluded)

ESTIMATED POPULATION OF CANADA

(net immigration—100,000 per annum)

1980

Age	Male 000	Male %	Female 000	Female %	Total 000	Total %
0–4	1,608.7	11.6	1,527.1	11.2	3,135.8	11.4
5–9	1,431.8	10.3	1,360.4	10.0	2,792.2	10.1
10–14......	1,293.6	9.3	1,230.4	9.0	2,524.0	9.2
15–19......	1,183.3	8.5	1,143.0	8.4	2,326.3	8.4
20–24......	1,147.9	8.2	1,092.3	8.0	2,240.2	8.1
25–29......	1,114.3	8.0	1,057.6	7.8	2,171.9	7.9
30–34......	1,001.3	7.2	937.3	6.9	1,938.6	7.0
35–39......	834.0	6.0	783.1	5.8	1,617.1	5.9
40–44......	735.4	5.3	680.0	5.0	1,415.4	5.1
45–49......	704.0	5.1	664.6	4.9	1,368.6	5.0
50–54......	680.9	4.9	676.1	5.0	1,357.0	4.9
55–59......	581.2	4.2	608.1	4.5	1,189.3	4.3
60–64......	504.8	3.6	542.4	4.0	1,047.2	3.8
65–69......	400.2	2.9	451.7	3.3	851.9	3.1
70–74......	298.4	2.1	342.2	2.5	640.6	2.3
75–79......	198.8	1.4	243.8	1.8	442.6	1.6
80–84......	121.8	.9	160.6	1.2	282.4	1.0
85–89......	59.4	.4	78.0	.6	137.4	.5
90+	22.7	.2	33.4	.2	56.1	.2
Total	13,922.5	100.0	13,612.1	100.0	27,534.6	100.0

APPENDICES — CHAPTER 5

COMPUTING PROGRAMME

Gross National Product

Row	Units	Item	Operations	1955	1965			1970			1975			1980		
No		**Net immigration assumptions**			50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000	50,000	75,000	100,000
1	000	Labour force and armed services		5,673.0	6,973.6	7,103.4	7,234.1	7,826.5	8,034.8	8,243.3	8,733.5	9,022.5	9,312.1	9,681.0	10,054.7	10,428.6
2	"	Armed services		118	120	120	120	120	120	120	120	120	120	120	120	120
3		Labour force	1—2	5,555.0	6,853.6	6,983.4	7,114.1	7,706.5	7,914.8	8,123.3	8,613.5	8,902.5	9,192.1	9,561.0	9,934.7	10,308.6
4		Employed labour force ÷ Total labour force		.9591	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97
5	000	Employed labour force	3x4	5,328.0	6,648.0	6,773.9	6,900.7	7,475.3	7,677.4	7,879.6	8,355.1	8,635.4	8,916.3	9,274.2	9,636.6	9,999.3
6		Population		15,573	19,215	19,518	19,822	21,159	21,643	22,128	23,314	23,989	24,665	25,773	26,653	27,534
7		Fed. & prov. govt. employment ÷ Population		.009439	.010316	.010316	.010316	.010754	.010754	.010754	.011193	.011193	.011193	.011631	.011631	.011631
8	000	Fed. & prov. govt. employment	6x7	147.0	198.2	201.3	204.5	227.5	232.7	238.0	261.0	268.5	276.1	300	310	320
9		Mun. govt. employment ÷ Population		004366	.004978	.004976	.004973	.005284	.005281	.005276	.005590	.005586	.005580	.005898	.005890	.005883
10	000	Mun. govt. employment	6x9	68.0	95.7	97.1	98.6	111.8	114.3	116.7	130.3	134.0	137.6	152.0	157.0	162
11		Health employment ÷ Population		.01226	.01558	.01561	.01566	.01724	.01729	.01736	.01890	.01896	.01906	.02056	.02064	.02077
12	000	Health employment	6x11	191.0	299.4	304.7	310.4	364.8	374.2	384.1	440.6	454.8	470.1	529.9	550	572
13	'	Employment in other community service		42.0	56.0	57.0	59.0	63.0	64.0	67.0	70.0	72.0	75.0	77.0	80	83
14		Employment in education (Universities		18.0	29.7	30.0	30.3	40.3	40.9	41.5	49.6	50.6	51.6	53.7	55.2	56.6
15		(Other		198.0	258.0	261.0	264.0	267.0	272.0	277.0	268.0	275.0	282.0	278.0	287.0	296
16	"	Employment in civ'n. govt. and community service sector	8+10+12+13+14+15	664.0	937.0	951.1	966.8	1,074.4	1,098.1	1,124.3	1,219.5	1,254.9	1,292.4	1,390.6	1,439.2	1,489.6
17		Employment in agr. and business	5—16	4,664.0	5,711.0	5,822.8	5,933.9	6,400.9	6,579.3	6,755.3	7,135.6	7,380.5	7,623.9	7,883.6	8,197.4	8,509.7
18		Employment in agr. ÷ employment in agr. and business		.1752	.1309	1309	.1309	.1135	.1135	.1135	.1003	.1003	.1003	.0897	.0897	.0897
19	000	Employment in agr	17x18	817.0	747.6	762.0	776.7	726.5	747.0	766.7	715.7	740.0	764.7	707.2	735.0	763.3
20		Employment in business	17—19	3,847.0	4,963.4	5,060.8	5,157.2	5,674.4	5,832.3	5,988.6	6,419.9	6,640.5	6,859.2	7,176.4	7,462.4	7,746.4
21		Employment in govt. and community service sector	2+16	782.0	1057.0	1,071.1	1,086.8	1,194.4	1,218.1	1,244.3	1,339.5	1,374.9	1,412.4	1,510.6	1,559.2	1,609.2
22	$49	G.D.P. per man in govt. and community service		2,727	2,820	2,820	2,820	2,820	2,820	2,820	2,820	2,820	2,820	2,820	2,820	2,820
23	hours	Average hours per week in agr. per man		55.3	48.75	48.75	48.75	47.0	47.0	47.0	45.5	45.5	45.5	43.75	43.75	43.75
24		Average hours per year in agr. per man	23x52.143	2,883.5	2,542.0	2,542.0	2,542.0	2,450.7	2,450.7	2,450.7	2,372.5	2,372.5	2,372.5	2,281.2	2,281.2	2,281.2
25	$49	Productivity in agr.		.99	1.169	1.169	1.169	1.355	1.355	1.355	1.534	1.534	1.534	1.735	1.735	1.735
26	$49	Output per man in agr.	24x25	2,854.7	2,971.6	2,971.6	2,971.6	3,320.7	3,320.7	3,320.7	3,639.4	3,639.4	3,639.4	3,957.9	3,957.9	3,957.9
27	hours	Average hours per week in business per man		41.3	37.75	37.75	37.75	36.75	36.75	36.75	35.4	35.4	35.4	34.3	34.3	34.3
28	'	Average hours per year in business per man	27x52.143	2,154.7	1,991.9	1,991.9	1,991.9	1,939.7	1,939.7	1,939.7	1,866.7	1,866.7	1,866.7	1,809.4	1,809.4	1,809.4
29	$49	Productivity in business (2.5% p.a.)		1.70	2.1760	2.1760	2.1760	2.4621	2.4621	2.4621	2.7856	2.7856	2.7856	3.1516	3.1516	3.1516
30	$49	Productivity in business (3.25% p.a.)		1.70	2.3407	2.3407	2.3407	2.7466	2.7466	2.7466	3.2229	3.2229	3.2229	3.7818	3.7818	3.7818
31	$49	Output per man in business (2.5% basis)	28x29	3,663.1	4,283.6	4,283.6	4,283.6	4,719.5	4,719.5	4,719.5	5,138.8	5,138.8	5,138.8	5,635.6	5,635.6	5,635.6
32	$49	Output per man in business (3.25% basis)	28x30	3,663.1	4,607.7	4,607.7	4,607.7	5,264.9	5,264.9	5,264.9	5,945.4	5,945.4	5,945.4	6,762.3	6,762.3	6,762.3
33	$49mn	G.D.P. in govt. and community service	21x22	2,132.6	2,980.7	3,020.5	3,064.8	3,368.2	3,435.0	3,508.9	3,777.4	3,877.2	3,983.0	4,259.9	4,396.9	4,539.1
34	"	G.D.P. in agr	26x19	2,342.3	2,221.6	2,264.4	2,308.0	2,412.4	2,480.6	2,546.0	2,604.7	2,693.2	2,783.0	2,799.0	2,909.1	3,019.9
35	"	G.D.P. in business (2.50 basis)	31x20	14,091.8	21,261.2	21,678.4	22,091.4	26,780.3	27,525.5	28,263.2	32,990.6	34,124.2	35,248.1	40,443.3	42,055.1	43,655.6
36	"	G.D.P. in business (3.25 basis)	32x20	14,091.8	22,869.9	23,318.6	23,762.8	29,875.1	30,706.5	31,529.4	38,168.9	39,480.4	40,780.7	48,529.0	50,463.0	52,383.5
37	'	G.D.P. at factor cost (ex. rents)(2.50 basis)	33+34+35	18,566.7	26,463.5	26,963.3	27,464.2	32,560.9	33,441.1	34,318.1	39,372.7	40,694.6	42,014.1	47,502.2	49,361.1	51,440.2
38	"	G.D.P. at factor cost (ex. rents)(3.25 basis)	33+34+36	18,566.7	28,072.2	28,603.5	29,135.6	35,655.7	36,622.1	37,584.3	44,551.0	46,050.8	47,546.7	55,587.9	57,769.0	60,168.1
39	"	Residential rents		823.6	1,060.0	1,100.0	1,140.0	1,278.0	1,340.0	1,402.0	1,523.0	1,600.0	1,677.0	1,837.0	1,910.0	1,990.0
	'	"Eleventh hour adjustments"			240.0	240.0	240.0	260.0	260.0	260.0	180.0	180.0	180.0	−80.0	−80.0	−80.0
40	"	G.D.P. at factor cost (2.50 basis)	37+39	19,390.3	27,763.5	28,303.3	28,844.2	34,098.9	35,041.1	35,980.1	41,075.7	42,474.6	43,871.1	49,259.2	51,191.1	53,124.6
41	"	G.D.P. at factor cost (3.25 basis)	38+39	19,390.3	29,372.2	29,943.8	30,515.6	37,193.7	38,222.1	39,246.3	46,254.0	47,830.8	49,403.7	57,344.9	59,599.0	61,852.5
42	'	Indirect taxes (2.50)	13% of 40	2,572.5	3,609.3	3,679.4	3,749.7	4,432.9	4,555.3	4,677.4	5,339.8	5,521.7	5,703.2	6,403.7	6,654.8	6,906.1
43	"	" " (3.25)	13% of 41	2,572.5	3,818.4	3,892.7	3,965.7	4,835.2	4,968.9	5,102.0	6,013.0	6,218.0	6,422.4	7,454.8	7,747.9	8,040.8
44	"	G.D.P. at market prices (2.50 basis)	40+42	21,962.8	31,372.8	31,982.7	32,593.9	38,531.8	39,596.4	40,657.5	46,415.5	47,996.3	49,574.3	55,662.9	57,845.9	60,030.7
45	'	G.D.P. at market prices (3.25 basis)	41+43	21,962.8	33,190.6	33,836.2	34,481.3	42,028.9	43,191.0	44,348.3	52,267.0	54,048.8	55,826.2	64,799.7	67,346.9	69,893.3
46		Net payments abroad of interest and dividends (incl. residual of 157.2 in 1955)		405.8	575.0	575.0	575.0	675.0	675.0	675.0	750.0	750.0	750.0	800.0	800.0	800.0
47	'	G.N.P. at market prices (2.50 basis)	44+46	21,557.0	30,797.8	31,407.7	32,018.9	37,856.8	38,921.4	39,982.5	45,665.5	47,246.3	48,824.3	54,862.9	57,045.9	59,230.7
48	'	G.N.P. at market prices (3.25 basis)	45+46	21,557.0	32,615.6	33,261.2	33,906.3	41,353.9	42,516.0	43,673.3	51,517.0	53,298.8	55,076.2	63,999.7	66,546.9	69,093.3

METHODS OF ESTIMATING THE INDUSTRIAL DISTRIBUTION OF THE EMPLOYED LABOUR FORCE, 1926

In this appendix we shall explain the methods by which the industrial distribution of the employed labour force from 1926 to date was estimated. This information is used at several points in this book and is shown in particular in the table entitled "Gross Domestic Product per Man-hour in Canada, by Sectors, 1926-55" that comprises Appendix F.

Conceptually the estimates are of the number of persons with jobs on the average throughout the year. The two main sources of information were *Canadian Labour Force Estimates, 1931-1950,* D.B.S. Reference Paper No. 23, and *The Labour Force, November 1945 to January 1955,* D.B.S. Reference Paper No. 58, together with subsequent monthly labour force bulletins. The information in the latter source derives from the sample surveys of the labour force conducted by D.B.S. since 1945, first on a quarterly and subsequently on a monthly basis, and is in all respects the firmest data that we have.

In using the published material, several problems were encountered:

(a) Estimates in the published documents are for the period 1931 to 1955 only so that estimates for the years 1926 to 1930 had to be developed;

(b) For all years prior to 1946 it was necessary to estimate the distribution of self-employed persons among industrial categories;

(c) As the figures available in Reference Paper No. 23 pertain, for the period prior to 1946, to June 1, it was necessary to convert them into averages for the year.

(d) As the industrial classification used in the source material differed from that in which we were interested, it was necessary to effect a reclassification of published estimates in some cases.

The methods followed in dealing with these problems are now described in some detail.

Adjustments to the Data for the Period 1931-45

For the period 1931 to 1945 inclusive, the material in Reference Paper No. 23 was utilized and subjected to the following adjustments:

(a) The allocation of the self-employed among the various sectors. In the reference paper, the figures for persons with jobs in agriculture include the self-employed, but a total of self-employed

is available only for the whole of the rest of the economy. This total has been allocated among the non-agricultural sectors of the economy on the basis of the average percentage of self-employed in each sector in the postwar period.

(b) The conversion of June 1 estimates to averages for the year. The monthly indexes of employment prepared in the Employment Section of the Labour and Prices Division of D.B.S. were used in making this conversion. For each year and for each sector, the ratio of the average index of employment for the year to the June index was calculated and multiplied by the June 1 employment estimate to obtain an estimate of the average employment for the sector in the given year.

Unfortunately, indexes of employment were not available for all sectors; they were not available for the agricultural, the hunting, forestry, fishing and trapping, or the finance, insurance and real estate industries. For these sectors the factor by which to convert a June 1 figure to a yearly average was taken as the average value of this conversion factor in the postwar experience as recorded in the labour force surveys.

Estimates for the Period 1926 to 1930

It was possible to carry some of the estimates for 1931 back to 1926 by utilizing D.B.S. employment indexes. It was possible to do this for the mining, public utilities, manufacturing, construction, and trade industries. The agricultural figures were obtained from an unpublished document prepared in one of the government departments. The figures for finance, insurance and real estate were obtained by utilizing figures from the 1921 and 1931 censuses as benchmarks. The straight-line interpolations of these were linked to the previous estimates for 1931. As the employment in this sector is relatively small, this rather crude method may perhaps be excused. For hunting, forestry, fishing and trapping, information on employment in forestry and fishing separately was obtained for the years 1926 to 1931 from data published by the Department of Northern Affairs in *Forest Products Statistics* and from the 1943 *Canada Year Book,* respectively. These data were totalled and converted into an index based on the year 1931, and the index was used to carry the original 1931 index back to 1926.

Adjustments of All Data to the Commission's Industrial Classification.

In all years an adjustment of the allocation of the labour force in the source material to the allocation implied by the definitions of sectors adopted for this study had to be made. This involved the division of public utilities into electric light and power on the one hand and other public utilities on the

other hand; the division of the services industries into government and community services on the one hand and business, personal and recreational services on the other hand; and the division of the manufacturing sector into primary manufacturing and secondary manufacturing. In the public utilities sector, information was obtained from D.B.S. on the ratio of employment in electric light and power utilities to total public utilities for some years. This ratio was applied to the estimate of employment in all public utilities for the years for which the ratio was available to yield an estimate of employment in electric light and power utilities for those years. Estimates for intervening years were obtained as follows: the figures resulting from a straight-line interpolation of the employment estimates were put in appropriate index number form and then divided into a D.B.S. index of employment in all public utilities and the quotient multiplied into the figures obtained from the linear interpolation. The estimates of employment in other public utilities were obtained by subtracting the figures for employment in electric light and power obtained above from the total for all utilities.

The division of the services industries involved more detailed estimating procedures. Broadly speaking, the method was the following: an estimate of employment in the total services group for all years from 1926 to date was made by the procedures outlined above; estimates for the government and community services portion were then made for each year and subtracted from the total to yield an estimate in the private services sector as a residual. The estimates of employment in the government and community services fields involved separate estimates of employment in the field of health, in universities, publicly controlled schools, other schools, religious activities, miscellaneous other community services, municipal governments, provincial governments and the federal government (the government sector was defined so as to include the Post Office, but not the C.B.C. and generally speaking, not any Crown corporations).

Figures of employment in the field of health were obtained from D.B.S. and adjusted to the levels shown in the censuses of 1931, 1941 and 1951.

Employment at universities was estimated by adding to the recorded counts of teachers an estimate of the number of employees not engaged in teaching—taken as one and one-half times the number of teachers.

Employment in publicly controlled schools for each year was taken to be the known number of full-time teachers plus an estimate of non-teaching employees. Employment connected with other schools was obtained for some years from D.B.S. estimates and for other years by interpolation. Throughout the field of education, estimates obtained in the way described yielded results in census years close to the census figures and, thus, the level of the figures in the entire series was adjusted so that the series would coincide with the census figures in the census years.

Figures of employment in religious activities and in other miscellaneous community services were obtained from the censuses for census years and were obtained by interpolation for the intervening years.

Employees of municipal governments were estimated separately, using our definition of the government sector which corresponds with that used in the National Accounts.

Figures are available of the number of municipal employees in the larger centres in Canada and in about 110 centres with populations ranging from 1,000 to 100,000. These centres were broken up into five size-groups and the ratio of population to municipal employment was computed for each group. This ratio was then applied to the *total* population in municipalities in each size-group as reported in the 1951 census and thus the total municipal employment in 1953—on the basis of the 1951 population—was computed. All the figures for municipal employment include an estimate of the number of full-time employees of municipalities with populations under 1,000. The number of municipal employees for other years was estimated from this base using total wage and salary payments by municipal governments divided by the estimated average per capita income of municipal employees. On this basis, it was possible to project the figure back to 1926. The figures thus estimated were compared in the census years with the figures reported in the census and they were found to be in close agreement. Consequently, the census figures were taken for 1931, 1941 and 1951 and the numbers were interpolated between these years on the basis of the direct estimate as described above.

The numbers of employees in provincial governments and the federal government in census years were taken from the censuses (with minor adjustments). For the intervening years use was made of detailed estimates derived especially for the purpose from a variety of sources, including payroll data.[1]

The definitions of primary and secondary manufacturing adopted in this study are apparently peculiar to the Commission. However, the employment figures in the annual census of industry can be classified according to our definitions of primary and secondary manufacturing. The relative sizes of the employed labour forces in these two sectors were calculated from these census data and applied to our estimate of the employed labour force in manufacturing as a whole to obtain the separate estimates of employment in primary and secondary manufacturing.

[1]The detailed estimates were also produced for census years and for those years were found to be substantially higher than the census figures. There is no immediately obvious explanation for the discrepancy; possibly some groups of persons on government payrolls are not always so classified in census enumeration. However, since other data on the labour force corresponded closely to census figures, we were obliged, in order to avoid double counting, to fix the government employment estimates to correspond with the levels shown in the census years. For the inter-census years the interpolated values of the ratios of the census figures to our estimates were applied to our estimates to yield the figures we have used. The result clearly is not wholly satisfactory.

Chapter 5, Appendix C

METHODS OF ESTIMATING AVERAGE HOURS WORKED PER WEEK PER MAN

It has been stated in the text, but must be repeated here, that data on hours worked are scarce. The situation in Canada in this respect is not different from that in other countries. Reliable figures on hours worked are both difficult and expensive to collect because the raw material is scanty and difficult to interpret. The estimates provided in this study are, of necessity, weak; it is hoped, however, that they may indicate trends if not absolute values. We have had to utilize some unpublished material worked up from primary sources (chiefly, information published in the *Labour Gazette* and derived from small monthly samples of wage earners taken by the Department of Labour) in one of the departments of the government and unfortunately it is not possible to give full details of the sources and methods underlying this material.

The unpublished series on which we have drawn pertain mostly to the period 1926 to 1930; material for the period 1945 to 1955 has been taken largely from publications of the Employment Section of the Labour and Prices Division of D.B.S. We have found it impossible to provide estimates for non-agricultural industries for the years 1931 to 1944 inclusive.

1. *Agriculture*

Figures on average weekly hours worked in agriculture have been obtained from the unpublished material referred to above. For the period 1926 to 1941, the estimates were produced in the following way: separate estimates of employment of family workers and hired labourers on farms were produced for June 1 of each year. From these, monthly estimates were produced using a seasonal index computed from postwar data. The monthly estimates were then averaged to get average annual employment of family workers and hired workers. It was then assumed that family workers worked an average of 300 days of 11½ hours each in 1926 and gradually reduced their working times to 290 days of 10 hours each by 1946. It was further assumed that hired workers worked an average of 260 days of 10¾ hours

each in 1926 and gradually reduced their working times to 250 days of 10 hours each by 1946. The average hours worked per year per man implied in these assumptions were combined in a weighted average using the estimates of average annual employment of family workers and hired labourers as weights to produce the figures of average hours worked per year per man in agriculture from 1926 to 1945.

For the period following 1945, results of the labour force survey could be used. In this survey, which was first conducted on a quarterly basis and later on a monthly basis, information was collected on average hours worked per week in agriculture.

Since 1953 when the labour force survey was first conducted monthly, 12 observations on hours worked and employment in agriculture are used directly to obtain average annual hours worked per man. Prior to 1953, while the survey was on a quarterly basis, average weekly hours and estimates of employment obtained from the survey were moved by the use of D.B.S. index numbers, hours worked and employment to yield estimates of hours worked in the last week of each month and employment at the end of each month in each year. A weighted average of these figures yielded the estimates of average annual hours worked per man in agriculture for the years 1946 to 1952 inclusive.

2. *Resources Industries*

In this study, resources industries are taken to comprise:

(a) Forestry, fishing, hunting and trapping

(b) Mining

(c) Electric light and power

(a) *Forestry, Fishing, Hunting and Trapping*

The data available here, which were derived originally from sample surveys conducted by the Department of Labour, pertain only to logging and are exceedingly hard to interpret. On the basis of conversations with persons representing industries in this group, we gained the impression that the average hours worked had probably not changed a great deal in this field and that a figure of 54 hours per week might be a fair guess.

(b) *Mining*

For the period 1926 to 1930, we have used the unpublished estimates referred to before (after some technical adjustments). For the period 1945 to date, we have used the D.B.S. series on average hours worked per week in mining.

(c) *Electric Light and Power*

For the early years 1926 to 1930, the unpublished series was again accepted. For the years 1945 to 1955, the estimate was based on figures for 1947 to 1952 derived from the annual reports on wage rates and hours of labour published by the Department of Labour and extrapolated to cover the whole period by the use of the movements in the series of average hours worked in manufacturing discussed below.

3. *Manufacturing*

In the early period 1926 to 1930, figures for average hours worked in the manufacturing sector as a whole were obtained from the unpublished material. In the postwar period from 1945 to date, the many D.B.S. series on average hours worked per week in a great variety of manufacturing industries were combined to produce estimates of average hours worked in the primary manufacturing group and in the secondary manufacturing group separately. These two series were then combined in a weighted average, using average annual employment figures as weights to yield the series of average hours worked in manufacturing as a whole for the postwar period. This series differs very slightly from the series of manufacturing as a whole published by D.B.S., because of slight differences in the weighting of component series.

4. *Transportation, Storage and Communication*

In the absence of information more directly relating to this sector, we decided to represent the average hours worked per year in this sector throughout the whole period by the figures for average annual hours worked per man in the manufacturing sector.

5. *Trade, Finance, Services and Construction*

(a) *Construction*

For the early years, the information was taken from the unpublished material; in the later years, the D.B.S. index for construction was used.

(b) *Other Public Utilities*

Average weekly hours worked per man in this sub-sector were taken to be the same as the average weekly hours worked per man in electric light and power utilities.

(c) *Trade*

Absolutely no direct information was available. In the United States figures there is some evidence that hours worked in retail trade and in manu-

facturing moved together. We have represented the average weekly hours worked per man in trade by the corresponding figures for manufacturing.

(d) *Finance, Insurance and Real Estate*

Again, no direct information was available. On the basis of very limited information from old issues of the *Labour Gazette*, we made the assumption that in the early period the figure of 44 hours and in the later period the figure of 39 hours could be taken as tolerably representative. These figures correspond to an 8-hour day in a 5½ day week in the old period, and roughly to an 8-hour day in a 5-day week in the later period.

(e) *Private Services*

For the period 1926 to 1930, average hours worked per week per man in this sector have been represented by a series pertaining to the workers in the laundries derived from the unpublished material. In the postwar period, the figures are represented by the D.B.S. series pertaining to laundries and restaurants, which, incidentally, is similar both in level and movement to a corresponding United States series covering a larger segment of the services industry.

6. *Total Industry and Total Business*

The figures for average weekly hours worked per man "in industry" (the whole economy except the government and community services sector) and "in business" (industry apart from agriculture) were computed as weighted averages of the component series, the weights being persons with jobs (see Appendix F).

Chapter 5, Appendix D

THE DIVERGENCE BETWEEN DEFLATED GROSS NATIONAL EXPENDITURE AND THE GROSS DOMESTIC PRODUCT VOLUME SERIES 1926 TO 1955

I. *Introduction and Summary*

The G.D.P. volume series, as described in Appendix E, is derived from indicators similar to the published Index of Industrial Production. These indicators attempt to measure changes in physical volume. They are weighted by the share of G.D.P. at factor cost of each industry in 1949. Hence each of the series can be multiplied by its 1949 weights, and the results added, so as to show the movement of the physical volume of output (G.D.P. at factor cost, henceforth G.D.P.) in terms of 1949 dollars.

The Gross National Expenditure (G.N.E.), on the other hand, is a series which shows in current dollars the expenditure on or the "sales" of each type of final output. This expenditure series is equal in total to the G.N.P., which in turn shows the total income from producing the physical volume of output measured by the G.D.P. at market prices.[1] To produce a companion series to the G.D.P., showing from another source the flow of output and income of the economy, it would be appropriate to show the G.N.P. in constant dollars. But the G.N.P., being an income series, cannot be easily deflated—indeed it is difficult to say what would be meant by deflated income. This difficulty is overcome in practice by deflating the G.N.E., that is, by showing what the expenditures on (or sales of) final products would be if these products were valued in 1949 (or 1935-39) prices. Since the current-dollar G.N.E. is equal to the current-dollar G.N.P., and since the G.N.P. is the income from producing the national physical output (which we refer to as G.D.P.) it should follow that the deflated G.N.E. and the G.D.P. would show the same movement over time.

This they do, but not exactly. It is the purpose of this Appendix to explore reasons for their divergence, the extent of which is shown in Table

[1]Subject to one or two minor adjustments.

5D. 1, column 1. These figures show the proportion that the G.D.P. volume series is of the G.N.E. excluding indirect taxes and net foreign dividends and converted into 1949 prices. (See Section VI(1) for detail of our adjustment of the G.N.E.) It should be observed that there is an average of 13% difference between the two series in the late 1920's. This difference gradually reduces as we approach 1949 when the two series were anchored together (the small difference between the two in 1949 being due to an inventory valuation adjustment). This gradual narrowing of the gap is indicative of the more rapid rise of the G.N.E. series than of the G.D.P. (It will be noticed that since 1949 the two series move at about the same rate of growth. In addition to the long-run difference between the two rates of growth, there is also to be observed a larger difference in the period 1931 to 1934.)

Table 5D. 1

	G.D.P. as % of deflated G.N.E. at factor cost	Indirect taxes as % of current-dollar G.D.P. at factor cost
1926	115.5	12.6
1927	113.5	12.2
1928	113.5	12.1
1929	110.3	12.0
1930	113.6	11.4
1931	119.3	13.1
1932	121.2	15.4
1933	117.2	16.6
1934	113.1	15.7
1935	111.3	14.8
1936	111.6	15.4
1937	108.6	14.4
1938	109.2	13.2
1939	107.0	14.0
1940	105.8	13.2
1941	107.1	13.7
1942	104.9	11.2
1943	103.6	10.9
1944	106.1	10.1
1945	100.5	9.1
1946	95.3	11.5
1947	96.3	12.9
1948	97.5	12.6
1949	98.9	12.2
1950	97.2	12.2
1951	98.8	12.8
1952	101.1	13.0
1953	101.0	13.3
1954	101.2	13.5
1955	100.4	13.4

It is suggested above that the deflated G.N.E. is not the counterpart of the G.D.P., though the G.N.P. is. What is the difference between Expenditure and Product?

In the first place, we have estimated that the G.D.P. is at "factor-cost". The weights show the importance of each industry's output in 1949 before that output is loaded with indirect taxes (less subsidies in the case of agriculture, coal mining and a few other industries). The annual indicators of change in physical output do not pretend to show changes in the government's fiscal policy, which are largely responsible for the periodic change of the percentage load of indirect taxation. Our G.D.P. series is thus, at factor-cost, exclusive of these fairly autonomous tax changes. Hence, it is necessary to deduct indirect taxes from the deflated G.N.E. if it is to be compared with the G.D.P. Our method and some of the consequences of doing this are discussed in Section VI below.

In the second place, the G.N.E. measures all expenditures in Canada on goods available for sale here. But since many of those goods are not produced here, they are not registered in the G.D.P. physical volume series (though the value of services used to haul, insure, develop and distribute them are to be found in the G.D.P.). Therefore, the G.N.E. is calculated by totalling all expenditures in a year on all types of final output and subtracting the imports of the year. This handling of imports raises some problems which are briefly discussed in Section VII.

In the third place, although the G.N.E. is equal to the G.N.P., both differ from the G.D.P. in that the latter is *domestic* product—while the G.N.P. is national product, meaning the income from production, wherever it is, that accrues to Canadian nationals, less the income from Canadian production that accrues to foreign owners and creditors of Canadian productive establishments. Hence, before the G.N.E. can be compared with the G.D.P. it is necessary to subtract from the former the *net* income paid to foreigners (i.e. net of dividends and interest paid by foreign enterprise to Canadian share and bondholders).

Finally, a negative point. It might be thought that depreciation would provide a source of differentiation between G.N.P. and G.D.P. This is not so. All measures here are inclusive of depreciation: *Gross* Domestic Product, *Gross* National Expenditure, and *Gross* National Product.

In what follows, we will use the word bias. This is a more or less technical word, and as such is free from implication of deliberate or conscious distortion. Rather, it refers to tendencies or forces which induce measures of economic change to rise more rapidly than other measures of the same thing. A volume indicator, method, or formula which is consistently higher than another has an upward bias; the lower of the two methods has a downward bias.

To be biased is a serious charge, but it is inevitable. It is inevitable because our problem in any constant-dollar series is to add together the physical

volume of unlike things: apples, trucks, roads, haircuts and pulp. This addition can only be accomplished if each separate volume series is weighted by prices or values, and the bias is introduced as soon as we decide that we will not use current dollars (because they confuse the picture by bringing in the changing price level) but the dollars of a particular year. Then, whatever year we choose will be alien to the other years in the series. The use of a particular year introduces a bias.

Let us anticipate the discussion below. We will find that the use of early year weights in quantity series introduces an upward bias, and the use of recent year weights introduces a downward bias—it minimizes the growth that has taken place. In a historical discussion, which is the best to use? Simon Kuznets, discussing a similar problem in his *Income and Wealth of the United States, Trend and Structure,* page 46 writes:

> "But while the use of a recent year as base results in a smaller rate of growth than the use of an initial or earlier year, . . . and in a sense imparts a *downward* bias to the estimates, I am inclined to argue that it is not a genuine bias. The less than threefold rise in the national product valued in 1929 prices . . . reflects the lower relative valuation assigned in 1929 to a unit of A compared with a unit of B. But all measures of growth in a sense reflect observations of a current generation looking into the past. We are interested in observing the past of historical developments as it leads from the past to the present, and a series that values the past as leading up to the present, values it, therefore, in terms of the present. We may be interested in the 1869 national product at its own current valuation, and in its components as reflected in the then current structure. But it does not make sense to talk of the 1929 product in 1869 prices, because 1929 was not within the framework of the 1869 generation in the sense in which 1869 was in the framework of the present generation. In other words, I would be inclined to view all measures of the past, when a comparable series is wanted, as oriented toward the present; and to use the present as the base for price valuation, accepting the implication that the magnitude of growth, the length of the path traversed would thus seem shorter to me as a member of the present generation than it might to my predecessor of 1869 were he to be resurrected and acquainted with what has happened while retaining the value scale of 1869."

The following table summarizes our conclusions about this and other types of bias. On turning to the sections referred to, the reader will frequently discover that there are offsetting sources of bias; the table however merely shows what in our opinion is the strongest of these.

Kuznets' remarks are directed to suggesting that the weighting bias he discusses is of a different kind from the biases which arise from choices of formulae or the omission of new products. We have not maintained this distinction, however, since we are merely attempting to discover which of two ways of measuring the output of the Canadian economy would be expected to grow the faster. We are not yet in a position to take Kuznets' detached attitude and to discuss which bias we would *prefer;* the reader will observe in the following table that we are not yet sure which biases affect our work, and which merely do so potentially.

We have omitted entirely from discussion in this appendix our own appraisal of our success in matching the G.D.P. weights with the output indicators. The data for this appraisal are available in the detailed lists of sources in Appendix E. But to test the biases by using different weighting patterns, or to test our matching of weights and indicators by trying alternative combinations, would occupy more time and resources than we could command. It is not impossible, however, that much of the subsequent discussion of biases is less important for an understanding of the discrepancy between the two methods of measuring real output than would be an analysis of our use of particular indicators to carry the 1949 G.D.P. weights of particular industries.

SUMMARY

Section	Source of divergence	Effect on G.D.P. at factor cost	Effect on Deflated G.N.E. at factor cost
II	Use of "gross"indicators	Bias down (weak)	Not applicable
	Weighting pattern:		
III	1949 values	Bias down	Not applicable
	1935-39 values	Bias up	Not applicable
VII	1935-39 prices	Not applicable	Bias up
IV	New products	Bias down (very weak)	Bias down (very weak)
V	Quality changes	Bias down	Bias down (weak)
VI	Changing burden of indirect taxes	None	Bias up
VII	Import prices decline	Not applicable	Uncertain

We must emphasize that the table merely summarizes our opinion of the most important and strongest sources of technical bias. The offsetting forces also at work are discussed in the following pages. Since we are most con-

cerned with the difference between the two series that appear in the 1930's, we have given less attention to the characteristics of the G.N.E. and the G.D.P. since 1949 (for example, a more complete discussion would contain an analysis of the 1949 internal weights that are used in the deflated G.N.E. and in the unpublished revised real output measurements since 1949).

II. *Use of "Gross" Indicators in the G.D.P. Volume Series (Neglect of Changing Quantity of Input per Unit of Output)*

In the discussion of the Index of Industrial Production (D.B.S. Reference Paper 34, pp. 13-14), it is shown that, for industries where both measures have been available, gross series have risen either more or less rapidly than net. However, the examples and graphs suggest that *usually* the net rate of growth is greater than the gross rate. In industries which are less self-sufficient than formerly (such as agriculture, resource industries and perhaps the service industries) the gross measure rises more rapidly. But industries which are achieving increasing economy in the use of inputs usually show a gross measurement rising more slowly than a net series. Since we believe the latter industries are predominant in Canada, and since, as will be seen in the next appendix, we were forced to use many gross measurements in compiling the G.D.P., we conclude that this may be a contributing factor to the slower increase of our G.D.P. than of the deflated G.N.E.

However, it is shown that a finer division of the measurements for specific industries into measurement for each of its products reduces this bias downward of gross indicators. Now the G.D.P. division was uniformly fine from 1935 to 1955, when the greatest discrepancy builds up. In 1926-35 the cumulation of differences between the two series is not apparently so large, yet the product division is much cruder, and the use of gross series much heavier. Therefore, it is not certain that the observed downward bias in the G.D.P. series has been reinforced by the use of gross series, since the discrepancy between G.N.E. and G.D.P. does not increase with the grossness (or aggregativeness) of the indicators.

III. *Weights and Formulae*

The over-all formula used in the G.D.P. series is basically an arithmetic average of relatives. However, the indexes used, which are also part of the published Index of Industrial Production, are calculated by an aggregative formula, and we have made some use of the early D.B.S. Index of Manufacturing Production, produced by A. Cohen, who used a geometric average of relatives. These three methods can be reduced to two, since relative formulae can also be expressed algebraically as aggregative formulae.

$$\frac{\sum\left\{\frac{q_1}{q_o} q_o p_o\right\}}{\Sigma\ q_o p_o} = \frac{\Sigma q_1 p_o}{\Sigma q_o p_o}.$$

Irving Fisher in his *The Making of Index Numbers,* showed by a series of elaborate tests that arithmetic formulae such as the average of relatives and the aggregative mentioned above are biased upward, whereas, as far as formulae are concerned, the geometric average of relatives method gives a lower final index number. For example, if two commodities of equal weight have increased in quantity by 120% and 150% respectively, the arithmetic average of these relatives would be 135, but the geometric average only 134.1. The arithmetic average invariably is higher than the geometric average of the same numbers or relatives.

To the extent, therefore, that the formulae used have produced an upward or downward tendency in the G.D.P. series, we may conclude that the predominant use of arithmetic formulae gives the series some upward formula bias which is probably partly offset by the use of the geometric formulae for two sectors of the economy in the period 1926-35. This formula effect, however, is of minor quantitative importance in comparison with the effect on the growth of an index-number series of the choice of a particular year as base. The quotation from Simon Kuznets in Section I of this appendix refers to downward bias arising from using early-year weights (although he argues, contrary to our usage, that this is not a genuine or technical bias at all). We turn now to the question of the effect of the choice of year for the series' weighting pattern.

As discussed on previous pages, the main weighting pattern of the G.D.P. series is that of the 1949 G.D.P. at factor cost. In other words, 1949 value weights are used. The revised unpublished volume indexes to which we have had access also have 1949 internal weights. However, many of the G.D.P. indicators have been taken more or less directly from the Index of Industrial Production which employs 1935-39 prices as weights. Furthermore, in early years for manufacturing Cohen employed 1926 value-added weights for the manufacturing indexes which we have used to carry our manufacturing G.D.P. back to 1926.

In aggregate, therefore, the G.D.P. series is based upon 1949 weights, but, in detail, earlier 1935 and even 1926 relative prices are influential.

What is the probable effect of this mixed weighting pattern? In Section I of this appendix we have discussed theoretically the belief that recent weights used in qauntity index formulae reduce the over-all rate of growth of the

index compared with the rate that would be observed if earlier weights were used. This, we said, is because the use of early-year weights emphasizes new products that have high prices or unit values in the initial period. Such weights also overemphasize the growth of the economy relative to the growth shown by a recently-weighted series by neglecting the fall in unit values of new products gaining larger sales. The stronger this inverse correlation of quantity and price over time, the greater the emphasis on growing industries in early-year weighted series. By the same token, recent weights give less emphasis to growing industries.

There has been no opportunity to test by comparison the net effect of the final weighting pattern of the total G.D.P. calculations. It is clear that recent weights are predominant (especially in manufacturing) for relatively large industrial aggregates. It is doubtful that these industries are so inclusive as to contain within themselves strong weighting offsets to the downward bias of a recent weighting system. The fairly fine division of industries within manufacturing and mining, for which individual 1949 weights are used, tends to assign recent, low, prices to most new manufactured products, even though many manufacturing indicators are *internally* weighted at 1935-39 prices.

A rough evaluation of these forces then would suggest that since 1949 weights predominate, the G.D.P. series is probably biased downwards, or at most is roughly balanced between upward and downward biases so far as weighting effects are concerned.

IV. *New Products*

If new products are not in existence in the early period, they may fail to be represented at all in volume indexes, which consequently understate the volume of output in recent periods giving a downward bias.

The use of fine detail as indicators for the D.B.S. volume indexes and the use of industry value weights for recent period make it unlikely that this particular source of downward bias is present. The use of a small weight, such as those for primary plastics or oil pipelines in 1949, is not serious as long as the indicator covers the whole range of output.

The danger of, for a while, missing new products may actually be stronger with the G.N.E.

V. *Quality Change*

Is the deflated G.N.E. likely to show bias because of quality change in the products measured? Constant-dollar series are likely to *understate* growth, if quality improvements are neglected in the price indexes used to deflate the current expenditure, but physical volume series, also, may fail to show changes in quality.

1. The deflation of consumption outlays is carried out so as to avoid this sort of bias. (See the *National Accounts, 1926-1950*, p. 125.) Many of today's durable goods are superior to those of 20 years ago, because of a shift of consumers' purchases to higher quality (and probably relatively dearer) goods at the expense of goods of cheaper materials or finish. Care is taken to make proper allowance for this by deflation by price indexes for each of many kinds of consumer outlay. Whatever bias does remain may in fact be present to an even greater extent in the G.D.P. volume indexes for the industries making the same consumption products because of failure to reflect changes in content of output. In other words, as far as consumption goods are concerned, the G.D.P. will have the greater downward bias because the detail of final product coverage is not so fine. The same is true for imports and for exports.

2. In a different sense, however, *all* goods available are of a higher quality than was known or available 20 years ago. It is almost impossible for either G.N.E. or G.N.P. to deal with this type of change, which characterizes all types of goods and services. For example, in the case of capital goods, there is a heavy preponderance of the use of wholesale building-material price indexes and labour wage rates in deflating construction and machinery outlays. No other price index can be used, since the "good" to be studied did not exist in its present form in early years, and therefore had no price. That is (with a possible exception in the case of residential housing) investment outlays on structures, plant, and equipment are deflated by the price change of their inputs. The probable consequence of this procedure is to neglect the increased economy or productivity associated with the use of these inputs in producing capital goods. This neglect has an effect similar to that of neglecting the quality improvement of consumer goods; it may lead to deflated series that understate the increase in "output" of such goods. To an even greater extent, this quality bias will also be present in the G.D.P. index number approach. The quantity indicators may fail to pick up improvements in the quality of the product.

Hence, it might be concluded here that with respect to quality changes:

(a) the deflated G.N.E. may be biased slightly downward (so that the series does not grow as fast as it would if it adequately took account of quality improvements),

(b) the G.D.P. may be biased even farther in the same direction.

However, these conclusions depend upon the products of new or improved quality being eventually worked into the G.N.E. or the G.D.P. with weights indicative of their eventual or long-run value. New products, it has been pointed out to us, are often introduced in the G.D.P. or the G.N.E. at their high initial prices. In this case, the G.D.P. will be biased upward

(by the "Kuznets effect" described in Section I); and the G.N.E. may have the same bias if the quality-adjusted price index is not introduced simultaneously with the quality change.

To the extent that the above arguments are correct, quality-change bias may account for part of the observed discrepancy between total G.D.P. and G.N.E., but we cannot be sure this bias will produce a faster growth of the G.N.E.

VI. *Indirect Taxes*

The G.D.P. series is intended to measure output at factor cost, is based upon factor cost weights, and is therefore conceptually independent of the changing burden of indirect taxes. The deflated G.N.E., on the other hand, is calculated by dividing final expenditures, including all indirect taxes, by the appropriate price indexes. In this section we will investigate whether part of the difference observable between the G.D.P. and the G.N.E. is to be attributed to the presence of indirect taxes in the G.N.E. and their absence in the G.D.P.

Before commencing the investigation, we must remind the reader that the 1949 *level* of the G.D.P. was adjusted to approximate equality with the G.N.E. at factor cost, before making the comparison of rates of growth. (We say approximate, because the 1949 G.N.E. at factor cost still differs from the G.D.P. at factor cost by the amount of the inventory valuation adjustment.) Hence, any difference in level between the two series in 1949 is not simply a matter of indirect taxes being included in one measure and excluded from the other.

It is probable, however, that the treatment of indirect taxes has had an effect on the movement of each series and that differences in treatment are related to the divergence between their rates of growth. Sales taxes and tariffs are for the most part added by businessmen to the selling price of final goods. Therefore price indexes that are used to measure changes in the prices and to deflate the values of such final goods are also affected by changes in tax rates. However, in Table 5D. 1, the G.N.E. at factor cost was derived by subtracting all indirect taxes from the current market value of final goods. That is, we have found it necessary to deflate an expenditure series less indirect taxes by an implicit price deflator, the year-to-year fluctuations of which were still affected by changing indirect taxes. Let us examine the consequences of this procedure.

1. If such taxes increase from year to year as a proportion of the G.D.P. at factor cost, the price indexes of final goods will also rise to the extent that such taxes are passed on to final purchasers. Such price indexes, when used to deflate the G.N.E. exclusive of indirect taxes, will reduce the G.N.E. too much in the years when indirect taxes are the highest, that is, in the

later years. The resultant constant-dollar G.N.E. at factor cost therefore, will rise less rapidly than the actual volume of goods sold; we may say that it has a downward bias.

Conversely, if over time indirect taxes decrease as a proportion of G.D.P. at factor cost, the deflated G.N.E. aggregate will rise too rapidly relative to the underlying volume change. This is apparently the situation which actually held between 1935 and the present. Table 5D. 1, column 2, shows that there was a slight but observable fall from a high of 16.6% of G.D.P. in 1933 to 12% or 13% today. For this reason we may infer that the G.N.E. has an upward bias over the period 1933-55 in relation to a volume series at factor cost.

It will be observed that from 1926-32 the ratio of indirect taxes to G.D.P. at factor cost was about the same as that ruling in 1955. It will also be observed that the discrepancy between the G.D.P. and the deflated G.N.E. was scarcely more serious in the '20's than it was in the middle '30's, 12% or 13% in each case. This is consistent with our inference that there is an inverse correlation between the change in indirect taxes as a proportion of G.D.P. at factor cost and the difference between G.N.E. and G.D.P.

2. Indirect taxes probably had another and independent effect on the two series. The deflated G.N.E. may be regarded as a volume index with base weights which are the value of various kinds of final product sold at *market price*. (This is demonstrated in Part VII.) The G.D.P., on the other hand, is a volume index with base weights that are the total amount of goods produced by various industries, each industry weighted by the base year output at *factor cost*. Although there are many differences in method between the two, we wish here to focus attention on the simple distinction that one series has market price weights and the other has factor cost weights.

The difference between market price and factor cost is the amount of indirect taxes attributed to the product or industry in question. Indirect taxes are not distributed evenly across the various products of the economy, nor among the various industries, but are most heavily imposed upon certain products and industries, such as tobacco products, alcoholic beverages, consumer durables and many luxury items. *If* the rate of growth of output of such products or industries differs from that of the economy as a whole, the rate of growth of an index computed for the entire economy will depend upon whether such heavily taxed products have been given their market price or factor cost weight. In the G.D.P. at factor cost, heavily taxed products are in a sense underemphasized, while in the G.N.E. they are overemphasized. The question to be answered is, have such heavily taxed products in fact grown more or less rapidly than the remainder of the economy?

It is very difficult to obtain precise information with which to answer this question. The reason is in part that the G.N.E. is a measurement of expenditure on final products, while the G.D.P. measures all output, intermediate and final. Apart from this difference in classification, it would be possible to obtain an indication of the answer by carrying out the calculation for the G.D.P. for the whole economy with two sets of weights, the first at market price and the second at factor cost.

While we have not had the time or resources to carry out these alternative calculations in full, we have recalculated the G.D.P. for manufacturing as a whole, using market-price weights, and have compared its rate of growth with that of our G.D.P. of manufacturing with factor-cost weights. It is felt that this is a reasonably fair test of the effect of the *sales* and *excise* taxes which bear heavily on consumer goods, although much of the *tariff* has its incidence outside manufacturing (for example, on imported capital goods used by resource and transportation industries). Further, *real estate* taxes, which form a respectable proportion of total indirect taxes, have their incidence on agriculture and on residential rents. Our test, therefore, applies to each of the different types of indirect tax to a different and uncertain extent, and refers only to manufacturing.

Before describing the outcome of the test, let us outline how we should interpret its results. The absolute level of the G.D.P. is not important. It is the rate of growth from the middle '30's to the present which we wish to examine, particularly the rate of growth from 1934-49, which was the period within which most of the discrepancy that we wish to explain arose. If it turns out in the test that the G.D.P. with market-price weights rises appreciably more rapidly than the G.D.P. with factor-cost weights, we can argue that the deflated G.N.E. which also used market-price weights has an upward bias relative to our own G.D.P. series.

The results as shown in Table 5D. 2 are a fairly good indication that the divergence between our two series was not caused by a difference between factor-cost and market-price weights. Column 1 shows our G.D.P. for total manufacture based on factor-cost weights. In column 2 is shown a very similar series, that has been calculated using roughly the same indicators with market-price weights. This series was then adjusted so that its level in 1949 was the same as that in column 1. Thus, column 1 and column 3 may be compared with respect to their rates of growth. The comparison is facilitated by column 4, in which column 1 is shown as a percentage of column 3. It will be seen that although there is a fluctuation in this ratio, there appears to be no long-run trend, such as that to be observed in the discrepancy between the G.D.P and the deflated G.N.E. The fluctuation may be accounted for in some instances by shortcuts taken in the calculation of the test.

To summarize this section of the influence of indirect taxes, we may say that there is some likelihood that point 1—the effect of indirect taxes on the price deflators—indicates that the deflated G.N.E. may have an upward bias

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Table 5D. 2

	G.D.P. (factor-cost weights) (1)	(2)	G.D.P. (market-price weights with 1949 = 4199.1) (3)	Col. 1 ÷ Col. 3 (4)
1935	1,716.1	2,043.2	1,701.3	100.8
1936	1,902.7	2,244.9	1,869.3	101.8
1937	2,178.6	2,564.6	2,135.5	102.0
1938	1,976.6	2,357.8	1,963.3	100.7
1939	2,122.3	2,546.4	2,120.3	100.1
1940	2,673.6	3,178.2	2,646.4	101.0
1941	3,511.2	4,120.4	3,431.0	102.3
1942	4,319.2	5,019.4	4,179.5	103.3
1943	4,727.2	5,445.4	4,534.3	104.3
1944	4,928.8	5,767.3	4,802.3	102.6
1945	4,210.8	5,003.1	4,165.9	101.1
1946	3,709.6	4,425.4	3,684.9	100.7
1947	4,016.5	4,801.4	3,998.0	100.4
1948	4,248.0	4,985.2	4,151.1	102.3
1949	4,199.1	5,042.9	4,199.1	100.0
1950	4,423.9	5,291.7	4,406.3	100.4
1951	4,743.0	5,604.0	4,666.3	101.6
1952	4,837.6	5,791.5	4,822.4	100.3
1953	5,211.6	6,240.5	5,196.3	100.3
1954	4,924.3	5,895.1	4,908.7	100.3

relative to the underlying volume series. With respect to point 2—that indirect taxes affect the weight given to industries exhibiting different rates of growth—we may say that we have little or no evidence that this effect has any quantitative importance.

VII. *Weighting Bias in the G.N.E.*

The point here is related to that made in Section III. There it was argued that rapidly growing products are characterized by falling prices, or prices that fail to rise as rapidly as those of other products as a whole. Therefore, in the G.D.P. (volume) index there will be a relative neglect of the rapidly growing series if they are weighted by recent low prices, and contrariwise a relative overemphasis if they are weighted by the earlier high prices. We concluded in Section III that the G.D.P. volume series was on the whole dominated by recent prices, and that therefore there was a tendency to understate the importance of growing industries; there was a downward bias in the G.D.P. series from this source.

Let us now examine the deflated G.N.E. We have already discussed the effect of indirect taxes, so let us abstract from their effect.

First we shall establish that the deflated G.N.E. is a quantity series weighted by the prices of the year to which the "constant dollars" are attributed.

The deflation of the G.N.E. is described at page 125 of the *National Accounts, 1926-1950*. The basic process is to take each item of the national expenditure in current dollars and deflate it by a price index. Let us assume

that there is complete disaggregation of products, so that the price index is merely a price for a particular item relative to the price of that item in the base year. Weighting does not come into the argument at this stage. When each item of expenditure has been deflated in this way, we have a constant dollar value which is the quantity sold in the given year times the price in the base year. When all such deflated sales are aggregated for the given year, we have a quantity index in which all current volume or quantities are weighted by the prices in the base year. Note that although we did not weight the price indexes, and used only simple price relatives, and though we merely added the values deflated by these relatives, we have emerged with a volume index which has base year weights—that is, weights for the year in which prices were taken as 100.

This can be shown algebraically (for an arithmetical example see the paper cited above by Simon Kuznets, p. 45). Since there are several levels of aggregation, the algebraic procedure actually used is more complicated than the following expressions suggest. The example immediately following, however, illustrates for a single commodity and for an aggregation of such commodities the essence of the National Accounts deflating procedure:

	PERIOD O	PERIOD 1
PRODUCT A :		
Current value index :	$\frac{p_0 q_0}{p_0 q_0}$	$\frac{p_1 q_1}{p_1 q_1}$
Price index :	$\frac{p_0}{q_0}$	$\frac{p_1}{p_0}$
Deflated series :	$\frac{p_0 q_0}{p_0 q_0} \div \frac{p_0}{q_0}$	$\frac{p_1 q_1}{p_0 q_0} \div \frac{p_1}{p_0}$
	$= \frac{q_0 p_0}{p_0 q_0}$	$= \frac{q_1 p_0}{q_0 p_0}$
PRODUCTS A,...,N:		
Current value index :	$\sum^{N} \frac{p_0 q_0}{p_0 q_0}$	$\sum^{N} \frac{p_1 q_1}{p_0 q_0}$
Deflated series :	$\sum^{N} \frac{q_0 p_0}{q_0 p_0}$	$\sum^{N} \frac{q_1 p_0}{q_0 p_0}$

The two expressions on the last line show that the deflated volume series is weighted by prices in the year for which price indexes were given as 100.

This is the main point, although there is one complication, which will be briefly stated here. If the goods are not, as in the above example, deflated

one by one by price relatives, but are deflated in larger non-homogeneous groups by aggregative price indexes with base year quantity weights, then the deflation amounts to providing a quantity index that has price weights for the current year. This is shown in the following algebraic example; it illustrates the effect of, for example, deflating total expenditure on a bundle of consumer goods by an aggregative consumer price index. As subsequent discussion will show, this is *not,* in general, the procedure followed by D.B.S. in obtaining the constant-dollar G.N.E.

	PERIOD 0	PERIOD 1
PRODUCTS A,...,N:		
Current value index:	$\dfrac{\sum^{N} p_0 q_0}{\sum^{N} p_0 q_0}$	$\dfrac{\sum^{N} p_1 q_1}{\sum^{N} p_0 q_0}$
Price index :	$\dfrac{\sum^{N} p_0 q_0}{\sum^{N} p_0 q_0}$	$\dfrac{\sum^{N} p_1 q_0}{\sum^{N} p_0 q_0}$
Deflated series	$:\dfrac{\sum^{N} p_0 q_0}{\sum^{N} p_0 q_0} \div \dfrac{\sum^{N} p_0 q_0}{\sum^{N} p_0 q_0}$	$\dfrac{\sum^{N} p_1 q_1}{\sum^{N} p_0 q_0} \div \dfrac{\sum^{N} p_1 q_0}{\sum^{N} p_0 q_0}$
	$= \dfrac{\sum^{N} p_0 q_0}{\sum^{N} p_0 q_0}$	$= \dfrac{\sum^{N} p_1 q_1}{\sum^{N} p_1 q_0}$

The final term in the last column shows that if a group of individual commodities are deflated in the aggregate, the resultant constant-dollar index is equivalent to a volume index weighted by current prices. Our general conclusion is that, the finer the disaggregation, the more the constant-dollar series is weighted by base year prices.[1] To apply this conclusion, we refer to the discussion in the first paragraph of this section. We argued there that rapidly growing products tend to fall in price. (This is equivalent to assuming that the value series of expenditure on such rapidly growing products would increase over time less rapidly than the volume series. For example, if we assume that all products face demand curves of identical price elasticity we would find that the prices of products that actually decline in supply would increase, those of moderately growing products would fall moderately, and those of rapidly growing products would fall the most. Now we know that products that have fallen in sales have done so chiefly because of a change in taste; and that products that have grown in sales at the same rate as the economy as a whole cannot easily be assumed to have fallen in price. So to deal with this second point we must assume that there are equi-elastic demand curves shifting outwards as the economy grows.)

[1]See following page for footnote.

If this assumption is accepted, and we assume for the moment that D.B.S. has succeeded in deflating each expenditure item in detail, we can conclude that the deflated G.N.E. series, as a base-weighted volume series, is influenced by the earlier high prices of products that have since greatly increased in sales: there is bias upward. However, to the extent that D.B.S. has had recourse to more aggregative base year price indexes as mentioned in the "complication" above, this bias is reversed and the deflated G.N.E. is biased downward.

The evidence presented by D.B.S. is as follows. We read in the *National Accounts, 1926-1950,* p. 125, in a discussion of the weighting pattern of the constant-dollar estimates:

> "While these implicit price indexes are currently weighted at levels at which they appear in the table, it should be noted that at the initial stage in the deflation process price indexes have been employed which, in many cases, are base weighted; that is, fixed weights have been attached to the price relatives, assuming that the expenditure pattern of the base period held throughout. Reference to the numerical illustration above may further clarify the point. It will be seen that the total of men's clothing in current dollars, which is made up of numerous items of clothing (line 1) is divided by a price index applicable to the total of men's clothing (line 2); this price index is weighted by a fixed pattern of expenditure on men's clothing, the one which prevailed in the base period. So long as the relative quantities of the various items, constituting the group "men's clothing" have changed in the same proportion, it is a matter of indifference whether they are base or currently weighted. However, if changes in the relative quantities purchased with the group

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1

If the N products are regarded as a single "group" of expenditures, and such types of expenditures are aggregated over M groups, the constant-dollar index resulting has current prices as individual weights and base-year values as group weights:

$$\frac{\displaystyle\sum^{M}\frac{\dfrac{\sum^{N} p_1 q_1}{\sum^{N} p_1 q_0}}{\sum^{N} p_0 q_0}}{\sum^{M}\sum^{N} p_0 q_0} = \frac{\sum^{M}\sum^{N} p_0 q_0 \dfrac{\sum^{N} p_1 q_1}{\sum^{N} p_1 q_0}}{\sum^{M}\sum^{N} p_0 q_0}$$

If the prices of the N commodities behave similarly over time, the index is equivalent to a base-weighted volume series, for the finer the dis-aggregation, the more likely it is that the N commodities will have similar price experience, and the better the approximation of the index to our first algebraic example.

take place, and in addition, the relative prices change, there will be a difference in the constant dollar estimates, depending upon whether current or base-weighted indexes are used. It is for this reason that the deflation was carried out in as much detail as possible; in order to make maximum allowances for changes in the pattern of quantities purchased, or in other words, to bring the results closer to a completely currently-weighted price index system. [Using a completely currently-weighted price index system produces a completely base-weighted volume index.]

"It is believed that, with the exception of exports and imports, the discrepancies which arise from the use of base-weighted rather than currently-weighted price indexes in the initial stage of the deflation process are not large enough to affect seriously the general conclusions which can be drawn from figures of Table 3. In the case of exports and imports, the discrepancies have been large enough to call for special treatment."

Thus we may assume that D.B.S. has succeeded, on the whole, in producing a base-weighted volume index (using a current-dollar expenditure series and a currently-weighted price index), and that any exceptions to this conclusion are not significant in aggregate. It will be seen that the use of 1935-39 weights in the deflation operation tends to give prominence in the postwar period to products which were originally high priced, even though such products may since have expanded in their share of total output and have fallen relatively in price. That is, such "early" weighting is likely to produce an upward bias in the deflated G.N.E. which is to be contrasted with the opposite bias produced in the G.D.P. series by its "recent" weighting pattern.

An additional complication may be briefly referred to here. The paragraph quoted above contrasts the method used for deflating the consumption series with that for the import series in the G.N.E. In Table 5D. 1 we can see the large divergence that appeared in the early '30's. Table 5D. 3 shows that this was a period of divergent price movements. Since the components of the consumption series are deflated in minor aggregates (compared with the finer deflation procedure used for imports) total consumption in constant dollars will be partly weighted by *current* prices. The deflated import series, on the other hand, will be more completely base weighted and thus will be dominated by those products which had the highest price in 1935-39, the weighting period for the G.N.E. The question to be asked is this: Will the dominance in the deflated import series of particular imports that were relatively high priced in 1935-39, in comparison with a consumption series that is currently weighted, tend to make the difference between the two (i.e. the G.N.E.) fall faster than it otherwise would? Is this a source of upward bias in the G.N.E.? Or have these particular imports declined in relative importance? This difference of weighting method is undoubtedly

Table 5D. 3

IMPLICIT PRICE DEFLATORS

	1930	1931	1932	1933	1934	1935	1936	1937	1945	1949	1954
Consumer	71.3	65.0	59.5	57.0	57.8	57.8	58.9	60.8	75.1	100	118.3
Exports	55.8	46.1	41.5	42.3	46.5	46.5	49.3	54.0	71.0	100	110.2
Imports	55.8	48.9	47.7	45.2	48.7	48.7	48.6	52.5	72.3	100	110.2
G.N.E.	66.7	64.4	56.9	56.9	56.8	56.8	58.9	60.4	76.7	100	122.9

responsible for some of the fluctuation of the total G.N.E., but there is not yet sufficient information available to trace its effects.

The question then arises: Were not the same forces working on the G.D.P. series? Generally speaking, the answer is no. The more successful the D.B.S. statisticians were in achieving complete coverage of products and industries, in the sense of obtaining detailed information on quantities of all items, the smaller the influence of current prices on the volume index. Both output (shipments) and materials are ideally physical volume indicators weighted by base year value—not values in the given year.

If, in the absence of physical volume measurements of the output of industry, deflated value series have been used as indicators, then imported raw materials will be deflated by the same "low" price index, and give a downward bias to net output. But to the extent that the coverage is high, deflation is not necessary. (For an analysis, see D.B.S. Reference Paper No. 34, pp. 21-22.)

This concludes our brief discussion of the biases inherent in our G.D.P. at factor cost. Evidence has not been sufficient and time has not been available to enable us to arrive at a defensible conclusion. As the summary table at the beginning of this appendix suggested, our belief is that, on balance, the deflated G.N.E. has characteristics which impart to it an upward bias, while the G.D.P. at factor cost has the opposite bias. But, to the extent it exists, systematic bias of this sort is only one part of the discrepancy between real ouput (G.D.P. in our study) and deflated expenditure (G.N.E.) measurements that must be investigated. To achieve perfect correspondence, it is probably necessary to set up every industrial establishment as an industry and as a producer of a fraction of final output; then to measure output and aggregate it by expenditure classes, and to measure deflated expenditure and aggregate it by industrial classes.[1] The opening and expanding of new regional markets and the associated change in demand for transportation and other services make it practically impossible for aggregated industries and expenditure classes to maintain similar coverage from year to year. The long-run problem for the statistician is to keep discrepancies from appearing; the present appendix has done little more than indicate that one exists.

[1]For an example, see W. B. Reddaway, "Some Problems in the Measurement of Changes in the Real Geographical Products", *Income and Wealth, Series I*, Cambridge, 1951. Another relevant discussion is in Richard Stone, et. al., *The Construction of Price and Quantity Index Numbers in National Accounting*, Cambridge, O.E.E.C., June, 1952, mimeographed.

Chapter 5, Appendix E

SOURCES OF THE WEIGHTS AND INDICATORS USED IN ESTIMATING THE GROSS DOMESTIC PRODUCT AT FACTOR COST, 1926-55, BY INDUSTRY AND BY SECTOR

THIS appendix provides the detail for the discussion of the G.D.P. as a measure of output in Part IV of Chapter 5. We discuss first the 1949 weights for the output series, then the sources of the indicators which were applied to the weights.

I. *The Weights*

The weights used were the contribution to 1949 G.D.P. at factor cost of each of the 42 industries covered in Table I of *The Inter-Industry Flow of Goods and Services, Canada, 1949,* D.B.S. Reference Paper No. 72, July, 1956. (Actually, we had access to preliminary results of this study, which covered 51 industries. Some revision took place between the time that we concluded our G.D.P. calculations and the publication of Reference Paper 72, so that the individual totals are not exactly the same, although the total for the whole economy is.)

An example will illustrate the derivation of the G.D.P. for a particular industry. If the reader will consult Appendix F he will see that the 1949 G.D.P. for forestry, fishing and trapping is given as \$365.2 million. If he will now turn to Table I of Reference Paper 72 he will see that forestry is shown in column 2 and fishing, hunting and trapping in column 3. In line 46 of these two columns, the wages, etc., paid by the two industries are given; in line 47 the corporation profits before taxes; in line 48 other income; and in line 51 depreciation allowances and similar business costs. These four items for the two industries, eight items in all, total \$365.2 million, the G.D.P. we have shown for our forestry, fishing and trapping industry. The primary incomes, for each of the 55 industries with which we worked, were our estimates of the 1949 G.D.P. weights.

It was necessary to subdivide or combine some of 1949 industry figures in order to work them into the Royal Commission's sevenfold industrial

sectoring scheme (I. Agriculture, II. Resource Industries, III. Primary Manufacturing, IV. Secondary Manufacturing, V. Transport, Storage and Communication, VI. Trade, Services and Construction, and VII. Government and Community Services). For example, non-ferrous metals smelting and refining, in our scheme a primary manufacturing industry, had to be distinguished from metal mining, a resource industry. More important, it was necessary to re-allocate electric light and power establishments from trade, services and construction to resource industries; to divide each of six industries into primary and secondary manufacturing segments; and to undertake three other operations which we now describe.

The first of these concerned the oil and mining industries. It will be seen that in Reference Paper 72, industry number 5 is described as coal mining, crude petroleum and natural gas. However, "contract exploration" for petroleum and natural gas is included in number 37, construction. In order to make our industries congruous with respect to classifications of output, labour and capital, we reduced the construction G.D.P. by $7.4 million and added this amount to the G.D.P. of the crude petroleum and natural gas industry. At the same time, and for similar reasons, $5.9 million of the G.D.P. of the public utility industry, which was connected with the distribution of natural gas, was transferred to other industries: $1.5 to petroleum and coal products, and $4.4 to the crude petroleum and natural gas industry. Again, $4.4 million of the G.D.P. of the quarrying and prospecting industry was transferred to the gold mining industry.

A second operation was concerned with residential and non-residential rent. The G.D.P. of the finance, insurance and real estate industry before the re-allocation operation was $1,156.4 million. However, more than half this amount was the imputed and actual rent of residential and non-residential property, treated in Reference Paper 72 as though it were paid to a dummy real estate industry (see Reference Paper 72, p. 10). Since we had the problem of matching weights with indicators of G.D.P. we decided to re-allocate such rents to the G.D.P. of the industry occupying the premises. From some points of view, this procedure is theoretically attractive as well, since it enables land and location to be treated as a factor of production in the same way labour and capital are. However, reliable statistics are not available in sufficient detail to permit an allocation of rent to each industry individually. Therefore, the re-allocation of rent was made to the seven *sectors* but not to the individual industries. This is one reason why the G.D.P.'s for each industry as shown in Appendix F do not add up to the G.D.P. for the sector in which they occur; imputed and actual rent have been added in to the sector total. (Own-account construction, discussed below, has also been added in to the sector G.D.P. totals.)

The $1,156.4 million mentioned above was divided up as follows: $50.2 to agriculture; $1.3 to resource industries; $2.0 to primary manufac-

turing; \$12.7 to secondary manufacturing; \$6.6 to transport, storage and communication; \$469.0 to trade, services and construction (of which \$323.8 represents the factor earnings of the finance, insurance and real estate industry proper and \$145.2 the rent of premises occupied by establishments in this sector); and \$614.6 to residential housing (of which \$146.9 is depreciation, etc., on non-farm housing, \$385.2 is interest and net rent on non-farm housing, \$65.5 is farm-owned residential housing, and \$17.0 is farm-paid rent). With the exception of residential rents, these amounts were added to and moved with the G.D.P. totals of the sectors using the property rented.

The third operation consisted of a re-allocation of the G.D.P. for construction. The figure of \$1,081.6 million includes all construction activity, whereas we wished to show only the output of the construction industry. Therefore, we first subtracted \$7.4 contract drilling for the oil industry, and then subtracted amounts representing the amount of own-account new and repair construction carried out by employees of other industries: zero for agriculture; \$17.0 for resource industries; \$7.5 for primary manufacturing; \$14.4 for secondary manufacturing; \$136.5 for transport, storage and communication; \$5.3 for trade, services and construction; and \$73.0 for government. This leaves \$820.5 as the output of the construction industry proper.

Both the second and third re-allocations are very rough. They were necessary because we wished in Chapter 6 to juxtapose the labour and the capital used in each sector with the output of the sector: therefore the output had to be as inclusive as possible. It is also arguable that it is more appropriate to move rent and own-account construction on indicators peculiar to each sector than on general rent or construction indexes. However, it must be admitted that we are not sure about the relationship between new and repair construction carried out by each sector on its own account. In grouping these two types of expenditure, we may have succeeded in showing the total output of the industry as a single estimate at the expense of greater accuracy which would have been possible had we at least relegated own-account new construction to be dealt with in combination with construction industry new construction. This point is mentioned again below in Section II, in discussing the indicators used for own-account construction in the various sectors.

The reader is again reminded that own-account construction and rent have not been allocated to individual industries, but to sectors. They are added to the total of the G.D.P. of the industries making up the sector, the grand total being shown as the G.D.P. of the entire sector.

We realize that in making the re-allocations, we have prevented easy comparison with Reference Paper 72. This is unfortunate, but we feel that the gain from ability to compare inputs with output more than offsets the inconvenience involved in searching in Reference Paper 72 for the exact

weights used here. As in the case of the indicators mentioned in the next part, the re-allocation of the 1949 weights was facilitated by access to work-sheets of D.B.S. Research and Development Division. The responsibility, however, for the decisions made is our own.

II. *The Indicators*

Having thus fixed the 1949 weights (or levels) for the economy-wide G.D.P. at factor cost, it was necessary to find indexes which would "move" these figures to each year from 1926 to 1955. For the most part the sources and methods described are self-explanatory, but the following additional remarks may be made. Where no other explanation is given, reference to *C.S.R.,* or the *Canadian Statistical Review* refer to the 1955 supplement (No. 2) to the *Canadian Statistical Review* prepared in the Business Statistics Section of the Research and Development Division of D.B.S. Where the pages following state that information was obtained from D.B.S., the reference is, in almost every case, to the Business Statistics Section of D.B.S. The Business Statistics Section has under preparation an index of the real volume of production with 1949 weights which will cover the whole economy. This index, however, is not yet completed, and we have been privileged to obtain in advance of revision the use of much material prepared for this index. There are real dangers in combining the published and the preliminary revised (and unpublished) indicators. We of course take full responsibility for the method and results.

We have also obtained information on wages and prices from the Labour and Prices Division and from the National Income Section of the Research and Development Division of D.B.S. Sources other than those mentioned above are given in the pages that follow.

I. *Agriculture*

1. *1935 to 1955*

The index used was provided by the D.B.S. Business Statistics Section. It is a "net" production indicator of the type discussed in Reference Paper No. 34, pp. 13-16, involving weighting in fine detail current-year quantities of inputs and outputs with base-year prices.

2. *1926 to 1935*

For this period we have used a series devised in the Economic Section of the Department of Trade and Commerce. This index employs an approximation to the method and concepts of the D.B.S. index referred to above, and agrees with it in overlapping years. It is not, however, adjusted from a cash to an accrual basis.

It should be mentioned that alternative measures of farm output are available. Most of these are of a "gross" type and are exemplified by the

index of output in the *Quarterly Bulletin of Agriculture* issued by the Canadian Department of Agriculture. All such gross indexes indicate more rapid growth since 1926 than the one employed in the present calculations. The reason for this is that as agriculture grows it employs more materials and fuel purchased from other sectors in the economy. Such purchases are subtracted from a net index and so reduce its rate of growth, but they are left in the gross index and thus give the impression of a very rapid increase in output which, however, depends upon inputs acquired from other sectors.

II. *Resource Industries*

1. *Forestry*

The 1935 to 1955 index was provided by D.B.S. Business Statistics Section on a gross output basis. The weights are 1935-39 to 1946; thereafter 1949 weights are used. Farm production of pulpwood and fuelwood are measured in agriculture rather than here; an adjustment is made for additions to inventories.

From 1926 to 1935 an indicator was devised using as source of material the Northern Affairs publication *Forest and Forest Products Statistics,* (at page 17, Table 6). The series were logs and bolts, pulpwood and fuelwood, including farm production, each weighted by their relative values in 1935-39 which were .41, .41 and .18 respectively.

2. *Fishing and hunting.*

From 1935 to 1955 the series was provided by D.B.S. Business Statistics Section on a gross output basis using 1935 to 1939 weights to 1946; thereafter, 1949 weights.

From 1926 to 1935 the series was built up from information as follows:

The landings of sea fish are shown in the *Canadian Statistical Review,* page 108;

The marketings of inland fish are shown in the *Canada Year Book 1947,* at page 431;

The quantity of furs (not from fur farms) is in the *Canada Year Book 1943-44*, page 272;

The 1935-39 weights for these three series were provided by D.B.S. and were .52 for sea fishing; .19 for inland fish; and .29 for fur trapping.

3. *Gold mining*

From 1935 to date, a gold volume index is given in the *C.S.R.*, page 23. From 1926 to 1935 gold production in ounces was used as an indicator. This is also in *C.S.R.*, page 69.

4. *Other metals*

For 1935 to 1955, we deducted the gold index with a weight of 52.186 from the total metals indicator given in *C.S.R.* This produced the other metals indicator.

From 1926 to 1935 other metals were carried back on a composite gross output indicator. The output of silver in ounces; of copper in pounds; of lead in pounds; of zinc in pounds; and nickel in pounds were given the 1935-39 weights of \$.4684, \$.1013, \$.0376, \$.0350, and \$.2511 respectively.

5. *Coal mining*

From 1935 to 1955 the indicator is given in *C.S.R.*, page 23. From 1926 to 1935 the indicator was total coal production (in tons) from the *C.S.R.*, page 64.

6. *Petroleum*

From 1935 to 1955 the indicator is as given in the *C.S.R.* From 1926 to 1935 the indicator was "Producers' Shipments" (in barrels) as published in the *C.S.R.*, page 65.

7. *Quarrying*

From 1935 to 1955 the indicator is as published in the *C.S.R.* From 1926 to 1935 an indicator was built up as follows:

> Sand and gravel was shown in the *Canada Year Book 1940,* page 319 and *Canada Year Book 1943,* page 295. The 1935-39 weight is given in Reference Paper 34 at page 72 as 3.854. The series for stone is to be found in the same tables as sand and gravel. The weight is 2.075. No other series were used for non-metallic minerals. In particular, granite and limestone are under-represented.

8. *Non-metallic minerals*

The 1935 to 1955 series is as given in the *C.S.R.* From 1926 to 1935 the indicator was built up as follows:

> Asbestos is to be found in the *Canada Year Book 1943* at page 320. Its weight is \$38.24 per ton.
> Gypsum may be found in the *Canada Year Book 1943,* page 320, with a weight of \$1.4812 per ton.
> Quartz is to be found in the *Canada Year Book* for various years. Its weight is \$.68191 per ton.
> Sodium sulphate may be found in the *Canada Year Book* for various years. (This series jumped drastically from 1929 at 5,000 tons to

1933 at 50,000 tons. However, the intervening years were missing.) The weight is $8.05.

Sulphur, to be found in *Canada Year Book 1946*, page 355, is weighted at $8.59 per ton.

9. *Electric power*

From 1935 to 1955 an indicator will be found in the *C.S.R.* at page 29. The indicator actually used was supplied by D.B.S. Business Statistics Section and differs from that published. From 1926 to 1935, the indicator was carried back, without distinction between the weights of primary and secondary power, on "total output of electric power" in millions of k.w.h. per month as shown in *C.S.R.*, page 62.

10. *Own-account construction*

New and repair construction for forestry, mining and central electric stations respectively were taken from *Private and Public Investment in Canada (PPI)*, deflated and converted to index form.

III. and IV. *Manufacturing Industries*

1. *1935 to 1955*

The indicators for these years are taken from the D.B.S. Reference Paper No. 34, the *Revised Index of Industrial Production*. A full discussion of this index is given there, pages 11 to 35. Most of the series of figures in Reference Paper 34 are kept up to date in the *Canadian Statistical Review* and historical series to date are published in the *C.S.R. 1955 Supplement*.

The indexes used for moving along 1949 weights were for the most part appropriate to the industries covered by those weights. That is, very little attribution for wider coverage was necessary. Problems arose occasionally when it was desired to separate primary manufacturing from secondary manufacturing, but these problems usually concerned the splitting of the 1949 G.D.P. weight rather than in finding indicators for annual movement. The only qualification for this statement is that some of the primary manufacturing industries, especially primary chemical products, and to a lesser extent some of the primary wood products industries, had to be moved on rather dubious indicators.

The indicators are classified by D.B.S. into two categories—first, annual indexes and second, monthly indexes. The annual indexes are primarily based upon the census of industry files and the detailed methods and discussion are found in Reference Paper 34 at pages 23 and 25.

As will be seen from the pie chart on page 28, something like 49% of the annual coverage is based on "net" output indicators. These indicators are of

the type discussed in the formulae on the top of page 22: a fixed-weight formula which weights the quantities of the various types of products by their prices in the base year, and also weights the inputs (such as materials used) by their prices in the base year. The remainder of the annual indicators are based on gross output (in which the changing quantity of inputs is not considered), on man-hours, or on the volume or the value of materials used.

The monthly indexes are based rather more on the gross volume of production. However, in industries representing 43% of the manufacturing value added in the base period, output is measured by man-hours.

These monthly indexes are averaged to provide annual indexes in years subsequent to the last census of production. Hence in the more recent years Reference Paper 34 and the *C.S.R.* do not provide us with a production index which is as accurate as in the earlier years. In particular, the period 1950 to 1955 is almost entirely covered by various types of monthly indicators. The result of this use of monthly indicators is probably to understate the growth in output.

Finally, a word of explanation about the "revised series" referred to at the beginning of Section II of this appendix. The *internal* weight of these indexes is 1949 value instead of 1935-39 value as in the case for most published indicators. Many of the acknowledgments below to D.B.S. refer to our use of these unpublished "revised indexes", with their different weighting pattern from that of earlier years.

The sources of indicators used is given in detail in the following list. In many cases, preliminary 1955 estimates have been obtained from D.B.S.

(a) *Primary manufacturing*

i) Non-ferrous metals smelting and refining:
C.S.R. page 29.

ii) Meat products:
C.S.R. page 24.
"Total meat products"

iii) Dairy products
C.S.R. page 24,
"Total dairy products"

iv) Fish processing:
Reference Paper 34, page 78.
"Net fish curing and packing".
1952 to 1954: *C.S.R.*, page 25 "canning and preserving"

v) Fruit & vegetable preparations:
Reference Paper 34, page 78.
"Net fruit & vegetable preparations".
1952-54: *C.S.R.*, page 25 "canning and preserving".

vi) Wood products:

a) Miscellaneous woods:
Reference Paper 34, page 84,
"Total miscellaneous woods".
From 1952 to 1954 figures were estimated for us by D.B.S.

b) Furniture:
1935 to 1951, Reference Paper 34, page 84,
"Furniture and mattress springs".
From 1952 to 1954 indicators from D.B.S.

c) Total wood products:
1935 to 1954, *C.S.R.*, page 28.

d) Veneers & plywoods:
From 1944 to 1951, Reference Paper 24, page 84,
"Veneers & plywoods".
From 1952 to 1954 from D.B.S.

vii) Paper products:

1935 to 1954, *C.S.R.*, page 27,
"Total pulp and paper".

viii) Non-metallic mineral products:

a) Abrasives:
1935 to 1947 Reference Paper 34, page 86.
From 1947 to 1954 a rough indicator was supplied by D.B.S.

b) Cement:
1935 to 1954, *C.S.R.*, page 29.

ix) Chemical products:

The weighting of the three products mentioned below was different from 1935 to 1945, than from 1946 to 1954, due to the change in the nature of plastics.

a) Acids, alkalis and salts:
1935 to 1945, Reference Paper 34, page 82.

1946 to 1954, the information obtained
from D.B.S.

b) Fertilizers:
1935 to 1945, Reference Paper 34, page 83.
From 1946 to 1954, D.B.S. estimate.

c) Plastics:
1935 to 1945, Reference Paper 34, page 83 plastics.
From 1946 to 1954, D.B.S. estimate.

(b) *Secondary manufacturing*

i) Bakery products:
C.S.R., page 25,
"Bread and bakery products"

ii) Distilled liquors:
1935 to 1951, Reference Paper 34, page 79,
"Distilleries net".
1952 to 1954, D.B.S. estimate

iii) Other beverages:
1935 to 1954, *C.S.R.*, page 25,
"Total beverages".
Adjusted for the "distilled liquors"
mentioned above to derive "other beverages"

iv) Confectionery and sugar refining:
1935 to 1954, *C.S.R.*, page 25,
"Miscellaneous foods—sugar"

v) Miscellaneous food preparations:
1935 to 1954, *C.S.R.*, page 25,
"Miscellaneous foods total".

Adjusted for sugar mentioned above; includes confectionery

vi) Tobacco and products:
C.S.R., page 25

vii) Rubber products:
C.S.R., page 26

viii) Leather products:
C.S.R., page 26

ix) Textile products:
C.S.R., page 26

x) Clothing:
C.S.R., page 27

xi) Furniture:
1935 to 1951, Reference Paper 34, page 84.
1952 to 1954, D.B.S. estimate

xii) Secondary wood products: total wood products less primary wood products

xiii) Paper products:
1935 to 1954, *C.S.R.*, page 27.
"Total paper products" adjusted for "total pulp and paper"

xiv) Printing and publishing:
C.S.R., page 27

xv) Primary iron steel:
C.S.R., page 28

xvi) Agricultural implements:
Reference Paper 34, page 84.
1952-54, estimates from D.B.S.

xvii) Other iron and steel:
C.S.R., page 28.
"Total iron and steel" was adjusted for "agricultural implements" and "primary iron and steel" as detailed in the foregoing

xviii) Transportation equipment:
1935 to 1954, *C.S.R.*, page 28,
"Total transportation equipment"

xix) Jewellery, silverware and non-ferrous metal products:
1935 to 1954, *C.S.R.*, page 28,
"Total non-ferrous metal products". Adjusted for "smelting & refining". No separate indicator was available for "jewellery and silverware"

xx) Electrical apparatus & supplies:
C.S.R., page 29

xxi) Non-metallic mineral products:
1935 to 1954, *C.S.R.*, page 29,
"Total non-metallic mineral products", adjusted for "abrasives" and "cement"

xxii) Products of petroleum and coal:
C.S.R., page 27

xxiii) Chemicals:
1935 to 1945, Reference Paper 34, page 83.
Brought up to date by *C.S.R.* and adjusted for "acids", "fertilizers" and "primary plastics"

xxiv) Miscellaneous manufacturing:
Reference Paper 34, page 86.
1952 to 1954 estimated by D.B.S.

2. *1926 to 1935*

In this period two indicators are available. One is that which appeared in the D.B.S. *Monthly Review of Business Statistics* (which is recapitulated in the issues of February, 1941 and February, 1944). Computed by the General Statistics Branch (later called the Business Statistics Branch), this particular indicator is nowhere described in detail as to method. Although the 1941 *Review* has brief notes on the foot of page 7 and what is presumably a breakdown of the index on page 8, it will be noted that the indicators are of a monthly nature heavily dominated by export and import figures and such curiosities as "oatmeal production" and "cigar releases". The complete coverage of this index from 1919 to 1943 will be found in the February, 1944, *Review* at pages 29-31.

An alternative index, and one that was actually used in the present calculations of G.D.P., was summarized in a booklet entitled *The Quantity of Manufacturing Production in Canada 1923 to 1929* which was produced by the D.B.S. Industrial Statistics Branch (now the Industry and Merchandizing Division) in 1932. Prepared by Mr. A. Cohen, the method used was set forth in some detail beginning at page 11. We see at page 13, for example, that the "flour milling" indicator (which we used in the G.D.P. calculations) employed 1926 value-added-by-manufacture weights for combining physical volume indicators of "wheat flour", "chopped grain feed", "shorts and middlings", "bran" and "rolled oats". The weights were combined geometrically within the "flour milling industry" and again within the group known as "vegetable products". Finally the groups were geometrically weighted to obtain a total for "all manufacturing industries".

However, it was possible by using the details shown in the tables at page 36 and the original D.B.S. worksheets to combine the indexes for individual industries with those weights now used for the Industrial Production Index for 1935-39. The consequence of this procedure is that *within* particular industries the weights are those of 1926 and the method of combining them is geometrical. As *among* industries, however, weights are those of 1935-39 and they are combined arithmetically.

The actual method of procedure was as follows:

(a) The G.D.P. for 1935 for primary manufacturing was added to that for secondary manufacturing, thus producing a G.D.P. for total manufacture. This total manufacturing G.D.P. was carried back to 1926 on the All Manufacturing Industries index from the 1932 booklet and the D.B.S. worksheets. The 1935 figure used 1949 weights as between main industries and 1935-39 weights as between sub-industries. These weights were combined arithmetically. The combined 1935 figure was carried back on a series which used 1926 weights combined geometrically. It is impossible to explain the preponderant weighting of the outcome in any precise manner.

(b) We then operated directly on primary manufacturing. Each 1935 G.D.P. figure in primary manufacturing was carried back to 1926 on the index for that particular industry. The following classificatory decisions were made ("primary" industries only):

i) Total wood products:
Flooring and hardwood
Planing mills
Sash and door factories
Saw mills

ii) Total paper products:
Pulp and paper
Roofing paper, etc.

iii) Non-ferrous metals, smelting and refining:
Same series.

iv) Non-metallic:
Cement and abrasive products

v) Total chemical:
Acids, alkalis and salts, and from 1926 to 1931 compressed gases; fertilizers.

vi) Meat products:
Animal oils and fats
Sausages, etc.
Slaughtering and meat packing.

vii) Total dairy products:
Butter and cheese
Cheese processed

Condensed milk
Other dairy products

viii) Fish curing and packing:
Same series

ix) Fruit and vegetable preparations:
Same series

x) Total grain mill products:
Flour and feed mills
(Later, flour mill industry)
Foods breakfast
Foods stock and poultry

These indicators were combined with value added weights for 1935-39. Some of the indicators were available back only until 1932 and in several of the industries we were obliged to use only one indicator from 1931 back to 1926.

3. *Own-Account Construction*

Estimates of new and repair construction for primary and for secondary manufacturing from *PPI*, pages 157 and following, were converted to constant dollars and used as indicators.

V. *Transport, Storage and Communications*

1. *Air Transport*

For 1935 to 1955, the indicator was an output series devised by D.B.S., net of fuel, tires and tubes but not of maintenance or parts and other supplies. It was not carried back to 1926.

2. *Inter-Urban Bus and Coach*

This series was an output series devised by D.B.S., net only of fuel, tires and tubes. It was not pushed back to 1926, as no information was available.

3. *Urban and Suburban Transportation*

This industry includes tramways and local bus lines. The 1935 to 1955 indicator was devised by D.B.S. From 1926 to 1935, *Canada Year Book 1937*, page 667, gave a series on passengers carried on electric railways, which was used as indicator; no indicator for bus lines was used in this period.

4. *Truck Transportation*

The 1935 to 1955 series was provided by D.B.S., net of fuel, tires and tubes. From 1926 to 1935 a trend line was used starting at 15 in 1926 and proceeding to 20 in 1935.

5. *Steam Railways*

From 1935 to 1955, a series on gross output to include express service was provided by D.B.S. This series is preliminary. From 1926 to 1935 two traffic series were taken from *C.S.R.*, page 134 with 1949 weights: freight revenue per ton-mile of 1.25 cents and 2.66 cents per passenger-mile.

6. *Oil Pipelines*

From 1949 to 1955 a series on gross output of oil pipelines was provided by D.B.S. No information is available prior to 1949, but the G.D.P. even in 1949 was very small.

7. *Stevedoring*

The 1935 to 1955 series was provided by D.B.S.

From 1926 to 1935 the indicator covered a combination of seagoing vessels entered and cleared (all nationalities) in freight tons weighted .18 and freight carried by all ships in Canadian canals weighted at .82. The seagoing data is from *Canada Year Book 1937*, page 691 and the canal data *Canada Year Book 1937*, page 696. The weights are for 1935-39 and are provided by D.B.S. The early indicators are rather unrepresentative of production, although the 1935 to 1955 series which was derived by D.B.S. from data on loadings was perhaps not much better. The early series probably overrepresents inland waterway stevedoring at the expense of seagoing loadings.

8. *Shipping*

The 1935 to 1955 series was provided by D.B.S. for freight only, using freight carried by Canadian-registered ships arriving at and departing from Canadian ports, and freight carried by Canadian-registered ships using inland and coastal waterways.

From 1926 to 1935 a composite indicator was used as follows:

Seagoing Canadian vessels entered and cleared measured in freight-tons (for fiscal years) in the *Canada Year Book 1937*, page 691. D.B.S. implicit 1935 weight for this series is .18.

The other series used was total traffic through Canadian canals: Canadian vessels registered tonnage in the *Canada Year Book 1937*, page 696. D.B.S. implicit weight for 1935 was .82.

9. *International Bridge, Tunnel and Ferry*

Series available from D.B.S. for 1935-55. Carried on sector total in earlier years.

10. *Storage*

From 1935 to 1955 a gross series was provided by D.B.S., covering both storage and handling of grain.

From 1926 to 1935 a composite series was built up as follows:

> The carryover at the beginning of the period for wheat, oats and barley was taken from *C.S.R.* page 103. Crop year 1925-26 was taken as calendar year 1926, etc. The total of the three carryovers was used as indicator. It will be noticed that this indicator does not measure the handling of grain but merely grain in storage.

11. *Other Storage*

The weight of this series is very small. The indicator from 1935 to 1955 was provided by D.B.S. It was not specifically carried back to 1926.

12. *Telegraph*

An indicator for this industry was provided by D.B.S. for 1935 to 1955. A substantially similar series was built up for the period 1926 to 1935 on the following basis:

> Land messages were weighted .79 and cablegrams at .21. Data are from the *Canada Year Book* for various years.

13. *Radio and Television*

From 1935 to 1952 D.B.S. used the wattage of radio stations as indicator. After 1952 television wattage made it impossible to compare this series with earlier years, so that employment was substituted. As no indicator was available prior to 1935, the G.D.P. level of 1.63 in 1935 was pushed back to 1.00 in 1926 by straight-line extrapolation.

14. *Telephone*

From 1935 to 1955 a gross indicator was provided by D.B.S. A substantially similar indicator was devised for the period 1926 to 1935. The number of telephones in use, *Canada Year Book 1937*, page 724, was weighted at .75. Long distance calls were taken from *Canada Year Book 1937*, page 726 and weighted at .25.

15. *Own-Account Construction*

New *and* repair construction from *PPI* for steam railways, telephones and other private and public utilities deflated and used as an indicator.

VI. *Trade, Services and Construction*

1. *Construction Industry*

From 1935 to 1955 the 1949 weight was moved on a total construction indicator from D.B.S. No distinction was made between new and repair work by the construction industry. However, the D.B.S. indicator covers also new construction by the employees of other industries. This combination of weight and indicator may lead to an understatement of the growth of the construction industry proper.

From 1926 to 1935 total new and repair and maintenance construction was taken from Table 14, page 151, of *PPI,* and deflated by Index 21B. This deflated series was used as indicator to carry back the 1935 construction figure.

2. *Public Utilities*

This industry consists of gas utilities with a weight of .40 and waterworks with a weight of .60.

Gas utilities were carried from 1935 to 1955 on a manufactured gas distribution indicator to be found in *C.S.R.* at page 29 for the years subsequent to 1950. The nature of the index from 1935 onward is discussed in Reference Paper 34 at page 73. It should be noted that the indicator is the net output of those establishments in which the main product is manufactured gas for sale as such. Those plants in which the principal product is coke but which also produce gas are classified to the coke and gas industry.

From 1926 to 1935 the gas industry indicator used was total gas sold in billions of cubic feet less "coke oven gas". The reason for subtracting coke oven gas is to bring the 1926-35 series into conceptual agreement with the 1935-55 series. The statistical agreement in overlapping years between the two series is actually worse when coke oven gas is subtracted than when it is left in, but the 1926 level is probably improved.

Waterworks. From 1935 to 1955 the series was produced by D.B.S on the basis of population in cities, towns and villages served by waterworks multiplied by large cities' average daily consumption per capita of water from 1935 to 1952.

To carry this series back to 1926 it would be necessary to know the population of municipalities with waterworks and the trend of water consumption. Instead of this population information, we have used the population trend of all urban places of 10,000 and more, regardless of whether those places have waterworks. The discrepancy in trend should not be great, although some places use the waterworks of neighbouring municipalities. The trend of consumption has a high of 125 gallons per day per capita in

1949 and a low of 108 in 1938. In 1935 the series had a level not greatly different from 1941, 1945 and indeed 1952. It was therefore assumed that the per capita daily consumption from 1926 to 1955 did not change greatly from that in 1935. The final outcome is that the series was carried back from 1935 on the population of urban places greater than 10,000.

3. *Wholesale and Retail Trade*

From 1935 to 1955 the weights for wholesale trade were combined with those for retail trade and moved on a single indicator supplied by D.B.S. This combination of weights means that the change in the structure as between wholesale and retail trade is ignored. This is a serious omission because it is likely that whatever increase in productivity has taken place in this sector has been connected with the improvement of the distribution of goods as among wholesalers, chain supermarkets and small retailers, and with the changed position of other types of wholesaling activity.

From 1926 to 1935 the series was carried on total retail sales deflated by the consumer price index for all types of consumer expenditure except shelter.

The alternative procedure for the whole period would have been to utilize the indexes of wholesale and retail trade published in the *Canada Year Book* for prewar years. This index, evidently an interpolation between the censuses of distribution, was apparently abandoned because the indicators proved unreliable.

4. *Finance, Insurance and Real Estate*

The measurement of the output of these industries is necessarily imprecise.

From 1949 to 1954 an output index of real estate agents plus finance and insurance employees was available from D.B.S. From 1935 to 1951 a finance, insurance and real estate indicator was available on a 1935-39 basis. This indicator, however, includes residential and other occupied premises' rents. It was adjusted by putting it on a 1949 equals 100 basis and subtracting from it a residential rents indicator with the weight of .54. It will be noticed that the finance, etc., indicator as adjusted still includes the movement of cash rents of leased business premises.

From 1926 to 1935 the incomes of unincorporated business in this industry were added to the wages and salaries paid by corporations in this industry. The total was deflated by the Department of Labour Personal Wage Rate Index with 1949 equals 100. Since this index was very inflexible during the depression, some doubt exists about its efficiency as a personal service deflator. However, it is believed that a large part of the employment in this industry is in banking and insurance enterprises, where wages and

salaries were in fact relatively inflexible during the depression. (On the other hand, insurance salesmen and own-account real estate enterprises probably suffered severe income reductions during the depression.) The lack of data in this sector results in there being very few alternatives among which to choose.

5. *Recreational Services*

From 1949 to 1955 a D.B.S. indicator was available. From 1935 to 1949 a deflated series of wages and salaries and net income of unincorporated enterprises was used. From 1941 to 1949 the deflator was average weekly wage and salaries in "Service" as given in the *Canada Year Book 1955*, page 782. This was linked to the general average wage index (*Canada Year Book 1947*, page 650) covering the years 1935 to 1940.

From 1926 to 1935 the same procedure was used, the deflator being the Department of Labour General Wage Rate Index with 1949 equals 100. The wages and salaries for this industry were primarily derived from the census of service establishments of Volume VIII of the Census of 1931, 1941 and 1951. Theatres and other recreational establishments are given in the census but the annual interpolation had been carried on the motion picture establishments figure. The series is not regarded as being very reliable.

6. *Business Services*

From 1949 to 1955 a D.B.S. quarterly index of output of business services was used. From 1941 to 1949 wages and salaries plus the net income of unincorporated enterprises were deflated by average weekly wages and salaries in finance, insurance and real estate as given in the *Canada Year Book 1955*, page 782.

From 1935 to 1940 the series was deflated by the General Wage Index of the Department of Labour, *Canada Year Book 1947*, page 650.

The wages and salaries data for this industry depend heavily on the census "professional service" category for 1941 and 1951. Interpolation between these census years was carried on advertising agencies until 1946 and on labour force data from 1946 to 1951. From 1926 to 1935 the indicator was wages and salaries plus income of unincorporated enterprises deflated by the Department of Labour General Wage Index.

7. *Personal Services*

From 1949 to 1955 we used the D.B.S. Personal Service Index. From 1935 to 1951 we used a series devised by linking three short-period series produced at D.B.S. and the Bank of Canada.

From 1926 to 1935 we used the sum of incomes of unincorporated business and wages and salaries of incorporated business deflated by the Department of Labour General Wage Index. This deflator is probably fairly suitable to this industry because many people in personal services are highly mobile as between the rest of the economy and this industry.

8. *Own-Account Construction*

Estimates of new and repair construction for the construction industry, waterworks, and for finance, services and trade from *PPI,* Tables 23, 61 and 66, were added, deflated and used as indicator.

VII. *Government and Community Services*

1. *Housing*

The indicator used for this sector from 1926 to 1955 was a D.B.S. index of the volume of residential rents with 1949 equals 100. This series consists of a deflated current dollar residential rent series including imputed residential rents. It is similar to the series used in the constant-dollar consumer expenditures in the National Accounts. From 1947 to 1955 the deflator used was modified for quality changes in housing units. The trend of this series agrees well with the shelter expenditure series worked out for the Commission's consumption study.

2. *Government Own-Account Construction*

The basic series here was taken from *PPI* and was total new construction and repair by government departments, page 149. It was deflated by the non-residential construction implicit price deflator in the *National Accounts,* Table 4. The assumption here is that government own-account construction activity was maintained at a constant proportion of all government construction including that undertaken by private contractors on behalf of the government.

3. *Armed Forces*

From 1935 to 1955 the indicator was supplied by D.B.S. It is not merely based on the pay and allowance of the armed forces but gives weight to the number of people at each rank.

From 1926 to 1935 this series was extrapolated backwards on a series of the strength of the armed forces obtained from the Department of National Defence. This latter series, of course, does not take account of differences in the rank composition of the armed forces.

4. *Government Service (Exclusive of Post Office)*

The government service series was deflated wages and salaries of federal, provincial and municipal government employees. The deflation was carried out on our behalf by D.B.S. This series covers a certain amount of education service provided by municipal employees, thus leading to some double counting of changes in educational services. This series does *not* take account of the changing rank composition of the civil service.

5. *Post Office*

From 1949 to 1955 the post office indicator was derived by D.B.S. from post office revenue deflated and weighted by changes in the type of service provided by the post office. This series was carried back to 1926 on a series which simply deflated the gross revenue of the post office (as given in annual editions of the *Canada Year Book*) by the over-all consumer price index.

6. *Community Service*

(a) The index for this industry is divided into five parts with weights as follows:

Education 31% (of which universities are 18% and primary and secondary schools 82%);
Hospitals 21% (includes doctors and nurses out of hospitals, optometrists and dentists);
Health 23%
Religion and religious institutions 5%
Welfare 4%
Other community 16%

The universities' component of the education index is made up 66% on the universities' enrolment and 33% on the number of teachers. In this way a rapid increase in enrolment is prevented from rapidly increasing the index unless teachers also increase.

The elementary school index on the other hand gives equal weight to the index of number of teachers and the number of students (50% each). The weight of students, therefore, is reduced below that in the university index. In the schools' index the series runs from 1935 to 1946. There is then a new benchmark series from 1946 to 1952 and a D.B.S. quarterly preliminary series from 1952 to 1954.

Most of the hospitals' index is based on patient-days adjusted for changes in the number of doctors, the number of nurses and the number of domestics. The 1935 to 1947 figures are based on earlier D.B.S. calculations. A rough

bridge has been formed between 1947 and 1949. From 1949 to date a D.B.S. preliminary quarterly series exists based on patient-days only.

The health indicator is based on income of doctors, nurses, etc., deflated by an index of doctors' fees in the consumer expenditure series. The index runs from 1935 to 1947 on this basis. A rough bridge has been made from 1947 to 1949. A D.B.S. preliminary quarterly series exists from 1949 to date.

Although the weights for religion, welfare and other community services total almost 90% that for education, no very useful indicator exists for them. Their weight, therefore, is applied to the education series in the case of religion and to the health and hospital series in the case of welfare and other community services.

(b) 1926 to 1935: The health and welfare portion of this series was carried back to 1926 on a wages and salaries series for health provided by D.B.S. This was deflated for us to provide a volume series of health and welfare expenditure. The series was used to carry back to 1926 both the hospital and the health figure for 1935

The education series mentioned above covers both schools and universities. The extension back to 1926, however, is carried exclusively on a "public schools" indicator. The enrolment in public schools in nine provinces was adjusted for the teacher-pupil ratio on the assumption that an increase in enrolment not accompanied by an increase in staff would not provide the same increase in output as a growth of staff equal to the rate of growth of enrolment. The use of a specific university indicator would not have changed the trend of this series.

GROSS DOMESTIC PRODUCT PER MAN-HOUR IN CANADA BY SECTORS, 1926-55

IN THE TABLE which comprises this appendix, the reader may find estimates of G.D.P. at factor cost, the employed labour force, average hours worked per week, total labour input per year and output per man-hour (productivity). We have already described and discussed the sources and methods underlying these estimates; it is necessary here merely to repeat a warning sounded on several occasions in Chapter 5 and its appendices and to state our reasons for publishing the information in full.

The warning is that for several reasons already given in the technical appendices, the figures are at best to be regarded as rough estimates. This is the more true the earlier the year to which they apply. We have used the figures essentially to give us indications of rates of growth; the absolute levels of the figures and the year-to-year movements of the figures have been of secondary interest to us. In fact, after reading our technical material, the reader may well have grave doubts as to whether the figures are satisfactory indicators of absolute levels or of year-to-year movements.

We are nevertheless publishing the figures for two reasons. First and foremost, they are the ones we have used. We believe them to be the best presently available for indicating such rates of growth as interested us. We feel it would be unwise and unfair to present our forecasts without making available to those who would consider them seriously, the record of the past, such as it is, which influenced our judgments. The second reason for publishing is that we earnestly hope others will try to improve the statistical record of Canada's economic growth. Our contributions have been made under considerable pressure, though with cordial co-operation from government officials as our repeated acknowledgments testify. If we state our problems, misgivings and results, and make the report on our experience readily available, then other, less harried students may perhaps benefit and save time.

GROSS DOMESTIC PRODUCT PER MANHOUR IN CANADA, BY SECTORS, 1926-1955

(1949 dollars)

	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
I Agriculture															
G.D.P. ($M)	2031.6	2151.0	2258.1	1612.5	1952.1	1633.9	1955.2	1413.6	1536.0	1670.6	1528.7	1485.2	1888.2	2183.4	2240.1
L.F. (000)	1181	1209	1225	1224	1160	1140	1159	1178	1197	1217	1236	1255	1274	1293	1260
Av. Hours	64.0	64.0	63.0	63.0	62.0	62.0	61.0	61.0	60.0	60.0	59.0	59.0	58.0	59.4	60.5
Total Labour Input per Year (M)	3941.0	4034.4	4023.9	4020.6	3749.9	3685.3	3686.3	3746.7	3744.7	3807.3	3802.3	3860.7	3852.7	4004.6	3974.6
Productivity ($)	.52	.53	.56	.40	.52	.44	.53	.38	.41	.44	.40	.39	.49	.55	.56
II Resource Industries															
G.D.P. ($M)	496.6	518.8	553.5	581.8	568.9	487.5	430.4	466.5	557.5	595.3	664.8	792.9	720.4	803.2	920.1
L.F. (000)	178	189	208	208	202	166	143	150	179	200	207	234	219	228	231
Av. Hours	53.1	52.9	52.9	53.2	52.5				—	—	—			—	
Total Labour Input per Year (M)	492.9	521.3	573.7	577.3	553.2	—	—	—		—			—		
Productivity ($)	1.01	1.00	.97	1.01	1.03			—	—	—		—			—
(a) Forestry, Fishing and Trapping															
G.D.P. ($M)	259.8	263.2	274.4	287.6	272.5	205.7	173.9	185.8	220.5	225.5	254.9	306.2	229.7	265.5	350.3
L.F. (000)	106	111	124	120	115	85	71	79	101	117	118	135	120	124	125
Av. Hours	54.0	54.0	54.0	54.0	54.0			—	—			—		—	
Total Labour Input per Year (M)	298.5	312.5	349.1	337.9	323.8		—		—		—				—
Productivity ($)	.87	.84	.79	.85	.84	—	—	—		—					—
(b) Mining															
G.D.P. ($M)	191.9	203.2	218.7	227.1	227.1	219.6	198.9	220.2	263.4	287.4	322.0	381.3	393.3	424.9	454.2
L.F. (000)	58	63	67	70	69	63	56	56	62	68	73	82	81	85	86
Av. Hours	52.1	51.7	51.6	52.4	50.7	—	—	—	—	—	—		—		—
Total Labour Input per Year (M)	157.6	169.8	180.3	191.3	182.4	—		—		—		—		—	
Productivity ($)	1.22	1.20	1.21	1.19	1.25			—	—			—		—	
(c) Electric Light & Power															
G.D.P. ($M)	40.1	48.2	54.2	59.6	60.0	54.2	53.2	57.5	70.3	77.2	83.2	91.4	92.0	98.6	110.4
L.F. (000)	14	15	17	18	18	18	16	15	16	15	16	17	18	19	20
Av. Hours	50.4	49.9	50.0	51.2	50.1	—		—		—		—		—	
Total Labour Input per Year (M)	36.8	39.0	44.3	48.1	47.0	—		—	—	—		—		—	—
Productivity ($)	1.09	1.24	1.22	1.24	1.28		—		—		—	—	—		—
III. Primary Manufacturing															
G.D.P. ($M)	408.8	422.7	456.6	472.3	449.0	372.1	323.8	347.7	412.0	448.7	505.8	566.4	519.1	566.0	669.0
L.F. (000)	171	182	187	196	168	135	121	119	133	145	153	166	164	163	179
Av. Hours	—	—		—		—		—		—		—		—	
Total Labour Input per Year (M)	—			—	—	—	—	—	—	—	—				—
Productivity ($)			—		—	—	—		—		—		—		
IV Secondary Manufacturing															
G.D.P. ($M)	1208.2	1304.4	1430.2	1525.0	1354.7	1191.6	996.5	974.1	1143.0	1267.4	1396.9	1612.2	1457.5	1556.3	2004.6
L.F. (000)	498	513	552	591	564	506	454	441	482	516	527	567	564	565	643
Av. Hours	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Labour Input per Year (M)		—		—		—	—	—	—	—	—		—		
Productivity ($)				—			—		—		—		—		
Manufacturing (Total)															
G.D.P. ($M)	1617.0	1727.1	1886.8	1997.3	1803.7	1563.7	1320.3	1321.8	1555.0	1716.1	1902.7	2178.6	1976.6	2122.3	2673.6
L.F. (000)	669	695	739	787	732	641	575	560	615	661	680	733	728	728	822
Av. Hours	50.3	50.3	50.1	50.4	48.0	—		—		—					—
Total Labour Input per Year (M)	1754.6	1822.7	1930.4	2068.1	1832.0	—		—		—			—		
Productivity ($)	.92	.95	.98	.97	.99	—	—	—	—				—		
V Transportation, Storage and Communication															
G.D.P. ($M)	673.5	718.9	813.8	757.4	678.1	603.8	523.6	482.7	518.2	535.0	584.5	611.0	544.0	630.9	773.3
L.F. (000)	278	286	303	313	296	265	230	220	225	234	241	252	245	249	253
Av. Hours	50.3	50.3	50.1	50.4	48.0	—	—	—	—		—	—		—	—
Total Labour Input per Year (M)	729.1	750.1	791.5	822.5	740.8	—	—		—	—	—	—		—	—
Productivity ($)	.92	.96	1.03	.92	.92			—		—		—	—		—

	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
I Agriculture															
G.D.P. ($M)	1903.4	2841.8	1910.9	2355.5	1782.3	1969.6	1827.7	1958.2	1892.0	2085.0	2338.5	2544.7	2406.6	1916.6	2342.3
L.F. (000)	1147	1068	1049	1067	1075	1186	1122	1096	1079	1018	940	887	858	873	817
Av. Hours	61.9	63.3	62.8	62.2	58.4	55.4	53.0	53.7	52.6	51.8	52.7	53.8	54.8	55.1	55.8
Total Labour Input per Year (M)	3701.9	3524.9	3434.8	3460.4	3273.4	3425.8	3100.6	3068.7	2959.2	2749.5	2582.9	2488.2	2451.5	2508.1	2355.7
Productivity ($)	.51	.81	.56	.68	.55	.58	.59	.64	.64	.76	.91	1.02	.98	.76	.99
II Resource Industries															
G.D.P. ($M)	936.0	935.9	886.9	867.7	895.2	922.6	981.7	1073.6	1073.3	1199.8	1391.3	1423.9	1484.1	1610.9	1819.4
L.F. (000)	255	240	201	190	180	216	219	228	221	239	271	267	254	267	297
Av. Hours	—	—			50.2	49.2	49.1	49.1	48.3	48.8	49.9	47.8	47.6	47.3	48.0
Total Labour Input per Year (M)	—		—	—	477.1	554.1	560.7	583.7	556.6	608.1	705.1	665.4	630.4	658.5	743.3
Productivity ($)		—	—		1.88	1.67	1.75	1.84	1.93	1.97	1.97	2.14	2.35	2.45	2.45
(a) Forestry, Fishing and Trapping															
G.D.P. ($M)	317.9	296.8	272.1	293.9	338.5	390.1	397.2	417.8	365.2	420.2	501.3	462.7	449.4	475.4	491.2
L.F. (000)	144	138	110	106	101	110	116	118	97	122	145	120	111	114	135
Av. Hours	—	—			54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
Total Labour Input per Year (M)	—		—	—	284.4	309.7	326.6	332,2	273.1	343.5	408.3	337.9	312.5	321.0	350.1
Productivity ($)		—			1.19	1.26	1.22	1,26	1.34	1.22	1.23	1.37	1.44	1.48	1.40
(b) Mining															
G.D.P. ($M)	484.5	490.9	458.6	415.8	403.4	367.1	394.6	453.7	489.8	535.4	609.8	658.3	716.1	802.2	957.2
L.F. (000)	89	80	69	62	54	76	71	75	86	77	81	94	92	101	109
Av. Hours		—			43.8	43.2	42.2	42.6	42.6	43.0	43.1	42.7	42.7	42.6	43.2
Total Labour Input per Year (M)	—		—	—	123.3	171.2	156.2	166.6	191.0	172.6	182.0	209.3	204.8	224.3	245.5
Productivity ($)	—	—	—		3.27	2.14	2.53	2.72	2.56	3.10	3.35	3.15	3.50	3.58	3.90
(c) Electric Light & Power															
G.D.P. ($M)	127.0	141.6	151.6	153.6	148.8	157.0	179.8	187.6	200.0	225.8	258.4	278.0	295.0	311.0	343.4
L.F. (000)	22	22	22	22	25	30	32	35	38	40	45	53	51	52	53
Av. Hours	—	—			48.6	47.0	46.8	46.5	46.5	44.3	44.0	42.6	42.4	41.9	42.3
Total Labour Input per Year (M)		—		—	63.4	73.5	78.1	84.9	92.1	92.4	103.2	117.7	112.8	113.6	119.4
Productivity ($)					2.35	2.14	2.30	2.21	2.17	2.44	2.50	2.36	2.62	2.74	2.88
III. Primary Manufacturing															
G.D.P. ($M)	788.1	846.2	872.8	891.8	854.2	895.4	977.5	1008.3	1014.2	1072.8	1151.1	1153.6	1196.6	1237.1	1324.7
L.F. (000)	192	214	224	239	232	267	280	284	284	286	301	293	298	300	313
Av. Hours		—	—		44.9	44.0	43.4	43.0	43.1	43.2	42.8	41.9	41.5	41.1	41.2
Total Labour Input per Year (M)	—		—		543.1	612.5	633.6	636.7	638.2	644.2	671.7	640.1	644.8	642.9	672.4
Productivity ($)	—	—			1.57	1.46	1.54	1.58	1.59	1.67	1.71	1.80	1.86	1.92	1.97
IV Secondary Manufacturing															
G.D.P. ($M)	2723.1	3473.0	3854.4	4036.9	3356.6	2814.2	3039.0	3139.7	3184.9	3351.1	3591.9	3684.0	4015.0	3667.2	3949.9
L.F. (000)	792	985	1098	1086	979	955	989	989	1027	1037	1054	1046	1090	1012	1049
Av. Hours	—	—	—	—	43.9	42.0	42.0	41.6	41.7	41.8	41.3	41.1	41.1	40.3	40.9
Total Labour Input per Year (M)	—	—		—	2240.9	2091.3	2165.8	2145.2	2232.9	2260.1	2269.7	2241.5	2335.8	2126.5	2237.0
Productivity ($)	—	—			1.50	1.35	1.40	1.46	1.43	1.48	1.58	1.64	1.72	1.73	1.77
Manufacturing (Total)															
G.D.P. ($M)	3511.2	4319.2	4727.2	4928.8	4210.8	3709.6	4016.5	4148.0	4199.1	4423.9	4743.0	4837.6	5211.6	4924.3	5274.6
L.F. (000)	984	1199	1322	1325	1211	1222	1269	1273	1311	1323	1355	1339	1388	1312	1362
Av. Hours	—	—			44.1	42.5	42.3	41.9	42.0	42.1	41.7	41.3	41.2	40.5	41.0
Total Labour Input per Year (M)		—			2784.5	2707.9	2798.8	2781.1	2870.9	2904.1	2946.1	2883.4	2981.7	2770.5	2911.6
Productivity ($)					1.51	1.37	1.43	1.49	1.46	1.52	1.61	1.68	1.75	1.78	1.81
V Transportation, Storage and Communication															
G.D.P. ($M)	439.7	1042.7	1189.5	1193.8	1186.1	1092.7	1159.2	1184.0	1195.8	1233.9	1329.4	1436.0	1455.0	1392.7	1486.0
L.F. (000)	266	289	307	314	327	346	374	372	367	377	399	423	424	393	401
Av. Hours	—	—	—	—	44.1	42.5	42.3	41.9	42.0	42.1	41.7	41.3	41.2	40.5	41.0
Total Labour Input per Year (M)	—	—			751.9	766.7	824.9	799.1	803.7	827.6	867.5	910.9	910.8	829.9	857.2
Productivity ($)				—	1.58	1.43	1.41	1.48	1.49	1.49	1.53	1.58	1.60	1.68	1.73

GROSS DOMESTIC PRODUCT PER MANHOUR IN CANADA, BY SECTORS, 1926-1955 (Concluded)

(1949 dollars)

	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
VI. Trade, Finance, Services and Construction															
G.D.P. ($M)	2194.4	2396.4	2646.2	2801.6	2571.3	2326.6	1971.2	1813.0	1912.1	2007.5	2152.3	2370.1	2276.9	2327.7	2496.8
L.F. (000)	828	890	939	1021	1045	1049	942	985	1064	1099	1154	1227	1137	1165	1230
Av. Hours	48.4	48.3	48.4	48.5	47.7	—			—						
Total Labour Input per Year (M)	2089.5	2241.3	2369.6	2581.9	2599.0					—	—	—	—	—	—
Productivity ($)	1.05	1.07	1.12	1.09	.99	—			—						
(a) Construction Industry															
G.D.P. ($M)	373.3	428.3	499.7	539.1	498.9	431.6	287.2	228.9	265.8	294.6	327.4	390.6	367.6	379.1	429.1
L.F. (000)	139	161	167	198	211	219	151	151	210	200	206	205	192	186	215
Av. Hours	45.7	45.6	45.7	45.0	46.1		—	—	—						
Total Labour Input per Year (M)	331.2	382.8	397.9	464.6	507.2	—	—		—	—	—	—	—	—	—
Productivity ($)	1.13	1.12	1.26	1.16	.98				—						
(b) Other Public Utilities															
G.D.P. ($M)	31.7	34.1	32.6	37.9	40.7	40.3	40.1	40.9	40.7	40.4	40.7	40.9	40.9	41.5	44.6
L.F. (000)	5	5	6	6	7	6	7	6	5	8	7	7	6	5	5
Av. Hours	50.4	49.9	50.0	51.2	50.1	—			—	—		—	—	—	—
Total Labour Input per Year (M)	13.1	13.0	15.6	16.0	18.3			—							
Productivity ($)	2.42	2.62	2.04	2.37	2.22	—	—		—	—	—	—	—		—
(c) Trade, Wholesale and Retail															
G.D.P. ($M)	997.4	1100.5	1198.3	1236.1	1095.0	1042.7	949.7	915.9	965.6	1016.6	1081.9	1166.1	1132.4	1178.7	1256.6
L.F. (000)	318	344	372	405	410	397	371	394	412	435	467	503	457	506	523
Av. Hours	50.3	50.3	50.1	50.4	48.0		—	—							
Total Labour Input per Year (M)	834.0	902.2	971.7	1064.3	1026.1	—				—	—	—	—		
Productivity ($)	1.20	1.22	1.23	·1.16	1.07	—			—	—	—	—	—	—	—
(d) Finance, Insurance and Real Estate															
G.D.P. ($M)	213.3	232.2	271.7	303.1	283.4	246.7	227.5	227.9	220.0	218.2	238.0	282.4	245.8	237.3	235.7
L.F. (000)	77	80	83	86	89	93	92	94	94	95	96	99	98	98	97
Av. Hours	44.0	44.0	44.0	44.0	44.0		—	—						—	—
Total Labour Input per Year (M)	176.7	183.5	190.4	197.3	204.0	—				—					
Productivity ($)	1.21	1.27	1.43	1.54	1.39	—				—	—	—			
(e) Services, Business, Personal and Recreation															
G.D.P. ($M)	501.3	516.2	549.5	585.1	561.8	482.9	397.0	335.4	352.5	367.0	388.3	406.6	409.8	408.7	442.9
L.F. (000)	289	300	311	326	328	334	321	340	343	361	378	413	384	370	390
Av. Hours	48.7	48.5	48.8	49.0	49.1	—	—	—	—			—	—	—	—
Total Labour Input per Year (M)	733.8	758.6	791.3	832.9	839.7	—									—
Productivity ($)	.68	.68	.69	.70	.67	—			—	—		—			
VII. Government and Community Service															
G.D.P. ($M)	715.2	754.2	786.3	822.2	861.5	869.5	837.9	783.9	815.7	831.4	844.7	896.3	952.8	1005.0	1335.8
L.F. (000)	251	260	269	274	288	299	304	297	307	309	315	308	325	326	417
Av. Hours			—	—	—				—	—	—			—	—
Total Labour Input per Year (M)	—	—	—	—			—	—	—	—	—	—			
Productivity ($)	—	—	—			—	—	—	—	—	—	—	—		
VIII. Total Industry Economy (ex Gov't.)															
G.D.P. ($M)	7013.1	7512.2	8158.4	7750.6	7574.1	6615.5	6200.7	5497.6	6078.8	6524.5	6833.0	7437.8	7456.1	8067.5	9103.9
L.F. (000)	3134	3269	3414	3553	3435	3261	3049	3093	3280	3411	3518	3701	3603	3663	3796
Av. Hours	55.1	54.9	54.4	54.4	52.9	—	—	—	—	—	—	—	—		
Total Labour Input per Year (M)	9003.7	9357.5	9683.5	10077.8	9474.4	—				—	—	—	—	—	
Productivity ($)	.78	.80	.84	.77	.80							—	—	—	—
IX. Total Business Economy (ex. Gov't and Agriculture)															
G.D.P. ($M)	4981.5	5361.2	5900.3	6138.1	5622.0	4981.6	4245.5	4084.0	4542.8	4853.9	5304.3	5952.6	5567.9	5884.1	6863.8
L.F. (000)	1953	2060	2189	2329	2275	2121	1890	1915	2083	2194	2282	2446	2329	2370	2536
Av. Hours	49.8	49.7	49.6	49.8	48.2						—	—	—	—	
Total Labour Input per Year (M)	5071.1	5338.2	5661.1	6047.4	5717.4		—	—					—	—	
Productivity ($)	.98	1.00	1.04	1.02	.98	—	—	—	—	—				—	—
1. G.D.P. Residential Rents ($M)	345.4	361.3	372.4	386.0	390.9	394.0	392.7	396.4	407.5	418.5	424.1	432.1	437.0	444.4	452.3
2. G.D.P. Total Economy ($M) (VII + VII + 1.)	8073.7	8627.7	9317.1	8958.8	8826.5	7879.0	7431.3	6677.9	7302.0	7774.4	8102.8	8766.2	8845.1	9516.9	10892.0
3. Total Civilian Persons with Jobs (000)	3381	3524	3678	3822	3718	3555	3348	3385	3582	3715	3827	4003	3921	3981	4121
4. Armed Forces (000) (incl. in VII)	4	5	5	5	5	5	5	5	5	5	6	6	7	8	92
5. Total Persons with Jobs (000)	3385	3529	3683	3827	3723	3560	3353	3390	3587	3720	3833	4009	3928	3989	4213

	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
VI. Trade, Finance, Services and Construction															
G.D.P. ($M)	2758.8	2821.4	2811.8	2815.8	3023.7	3646.0	3944.1	3906.7	4235.0	4477.4	4483.0	4797.8	5056.9	5114.5	5511.8
L.F. (000)	1169	1222	1193	1155	1160	1280	1399	1432	1463	1507	1590	1678	1719	1722	1787
Av. Hours					42.8	41.6	41.5	41.2	41.3	41.4	41.3	41.4	41.3	40.4	40.5
Total Labour Input per Year (M)	—		—		2588.4	2778.7	3028.5	3075.3	3148.0	3255.0	3425.6	3625.5	3697.5	3628.7	3773.6
Productivity ($)					1.17	1.31	1.30	1.30	1.35	1.38	1.31	1.32	1.37	1.41	1.46
(a) Construction Industry															
G.D.P. ($M)	535.0	566.1	539.1	434.0	443.9	580.1	672.0	767.2	820.5	857.4	887.8	970.7	1044.5	1060.1	1187.3
L.F. (000)	211	221	207	160	165	228	254	289	321	337	351	344	352	333	367
Av. Hours				—	38.9	38.4	39.3	39.2	39.7	39.9	40.3	41.6	41.6	40.3	39.9
Total Labour Input per Year (M)			—		334.7	456.5	520.5	590.7	664.5	701.1	737.5	746.1	763.5	699.7	763.5
Productivity ($)		—			1.33	1.27	1.29	1.30	1.24	1.22	1.20	1.30	1.37	1.52	1.56
(b) Other Public Utilities															
G.D.P. ($M)	46.7	49.6	50.9	52.9	54.2	55.4	57.8	60.4	61.4	64.4	66.8	68.6	71.4	78.9	84.2
L.F. (000)	5	4	5	6	4	3	6	6	7	6	6	6	7	8	9
Av. Hours	—				48.6	47.0	46.8	46.5	46.5	44.3	44.0	42.6	42.4	41.9	42.3
Total Labour Input per Year (M)					10.1	7.4	14.6	14.6	17.0	13.9	13.8	13.3	15.5	17.5	19.9
Productivity ($)		—		—	5.37	7.49	3.96	4.14	3.61	4.63	4.84	5.16	4.61	4.51	4.23
(c) Trade, Wholesale and Retail															
G.D.P. ($M)	1345.0	1349.2	1366.0	1454.4	1603.9	1957.5	2109.5	2043.8	2104.8	2258.5	2180.6	2355.3	2530.0	2527.9	2727.8
L.F. (000)	492	501	485	492	508	574	637	650	652	645	718	785	815	818	836
Av. Hours		—			44.1	42.5	42.3	41.9	42.0	42.1	41.7	41.3	41.2	40.5	41.0
Total Labour Input per Year (M)				—	1168.1	1272.0	1404.9	1420.0	1427.8	1415.8	1561.1	1690.4	1750.8	1727.4	1787.2
Productivity ($)	—	—	—	—	1.37	1.54	1.50	1.44	1.47	1.60	1.40	1.39	1.45	1.46	1.53
(d) Finance, Insurance and Real Estate															
G.D.P. ($M)	250.0	259.7	245.8	244.1	256.8	301.1	323.2	330.3	323.8	342.3	377.9	384.7	385.6	407.0	417.7
L.F. (000)	93	100	103	106	110	124	131	140	144	142	154	162	165	167	176
Av. Hours	—	—	—		39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Labour Input per Year (M)	—	—			223.7	252.2	266.4	284.7	292.8	288.8	313.2	329.4	335.5	339.6	357.9
Productivity ($)				—	1.15	1.19	1.21	1.16	1.11	1.19	1.21	1.17	1.16	1.20	1.17
(e) Services, Business, Personal and Recreation															
G.D.P. ($M)	485.0	497.8	511.8	531.7	558.3	622.8	642.3	652.5	774.0	794.8	810.1	849.2	842.0	857.4	898.5
L.F. (000)	368	396	393	391	373	351	371	347	339	377	361	381	380	396	399
Av. Hours	—	—	—	—	43.8	43.2	42.5	42.3	42.7	42.5	42.5	42.6	42.2	40.9	40.4
Total Labour Input per Year (M)	—	—			851.8	790.6	822.1	765.3	745.9	435.4	800.0	846.3	832.2	844.5	840.5
Productivity ($)					.66	.79	.78	.85	1.04	.95	1.01	1.00	1.01	1.02	1.07
VII. Government and Community Service															
G.D.P. ($M)	1869.0	2288.4	2862.9	3057.1	2830.8	1633.9	1469.0	1500.5	1570.1	1646.7	1755.2	1881.4	1977.9	2059.4	2132.6
L.F. (000)	597	802	1053	1171	1165	650	497	520	549	579	624	674	707	740	782
Av. Hours	—	—	—				—			—	—	—	—	—	—
Total Labour Input per Year (M)					—	—				—		—	—	—	—
Productivity ($)				—	—	—		—		—			—	—	—
VIII. Total Industry Economy (ex Gov't.)															
G.D.P. ($M)	10049.1	11961.0	11526.3	12161.6	11098.1	11340.5	11929.2	12360.5	12595.2	13420.0	14285.2	15040.0	15614.2	14959.0	16434.1
L.F. (000)	3821	4018	4072	4051	3953	4250	4383	4401	4441	4464	4555	4594	4643	4567	4664
Av. Hours					47.9	46.2	45.1	44.9	44.7	44.4	44.3	44.1	44.1	43.7	43.7
Total Labour Input per Year (M)					9874.8	10229.1	10314.1	10308.7	10338.6	10344.5	10523.5	10571.6	10670.8	10394.6	10627.0
Productivity ($)	—	—	—		1.12	1.11	1.16	1.20	1.22	1.30	1.36	1.42	1.46	1.44	1.55
IX. Total Business Economy (ex. Gov't and Agriculture)															
G.D.P. ($M)	8145.7	9119.2	9615.4	9806.1	9315.8	9370.9	10101.5	10402.3	10703.2	11335.0	11946.7	12495.3	13207.6	13042.4	14091.8
L.F. (000)	2674	2950	3023	2984	2878	3064	3261	3305	3362	3446	3615	3707	3785	3694	3847
Av. Hours					44.0	42.6	42.4	42.0	42.1	42.3	42.1	41.8	41.7	41.0	41.3
Total Labour Input per Year (M)		—	—	—	6601.4	6800.6	7213.5	7240.0	7379.4	7595.0	7940.6	8083.4	8129.3	7886.5	8283.5
Productivity ($)	—	—	—	—	1.41	1.38	1.40	1.44	1.45	1.49	1.51	1.55	1.61	1.65	1.70
1. G.D.P. Residential Rents ($M)	462.8	475.7	487.4	498.4	508.3	522.4	537.2	570.3	614.6	652.7	690.2	714.8	749.2	787.3	823.6
2. G.D.P. Total Economy ($M) (VII + VII + 1.)	12380.9	14725.1	14876.6	15717.1	14437.2	13496.8	13935.4	14431.3	14779.9	15719.4	16730.6	17636.2	18341.3	17805.7	19390.3
3. Total Civilian Persons with Jobs (000)	4157	4366	4432	4435	4357	4687	4844	4886	4948	4996	5111	5173	5246	5194	5328
4. Armed Forces (000) (incl. in VII)	261	454	693	787	761	213	36	35	42	47	68	95	104	113	118
5. Total Persons with Jobs (000)	4418	4820	5125	5222	5118	4900	4880	4921	4990	5043	5179	5268	5350	5307	5446

APPENDICES — CHAPTER 6

Chapter 6, Appendix A

RECONCILIATION OF INVESTMENT SERIES

In this appendix we continue the reconciliation of the estimates of investment shown in tables in this chapter with those published by official sources. In Chapter 6 Part VI we showed that our forecast of National Accounts' investment was based upon a concept of industrial investment which almost, but not completely, coincided with two published categories.

Table 6A. 1 compares the two series, by juxtaposing our own constant-dollar series and the series of constant-dollar gross domestic investment in non-residential construction, combined with investment in machinery and equipment. The differences between the two are attributable to three causes:

1. *The Difference in Definition.* This difference amounted in 1949 to $95 million out of approximately $2,131 million investment in industrial capital, or slightly less than 4%.

   The precise reconciliation for 1949 is given in Table 6A. 2. In this table we show first, investment by industry as taken from *PPI*; second, as taken from the National Accounts adjusted for the institutions mentioned above; and third, our own total (ICS). In each case the adjusted figure is 2,130 million. The reason for choosing 1949 is that in this year it was not necessary to deflate totals to put them into constant dollars.

2. *The Difference in the Methods of Deflation.* Our own method has involved using price indexes not employed by D.B.S. in obtaining National Accounts' investment in 1949 dollars. Further, the weighting of the deflators is different from that in the National Accounts, since our deflation has proceeded industry by industry rather than on an aggregative basis.

3. *An Adjustment for the Period 1926-32.* Investment in machinery and equipment by the food and beverage industry 1926-32 as given in *PPI* is overstated. This overstatement had the effect of throwing out estimates in *PPI* for other industries. The amount of the necessary adjustment is shown in Appendix C in the discussion of columns 3 and 4.

Table 6A. 1

TOTAL INVESTMENT: COMPARISON OF NATIONAL ACCOUNTS WITH INDUSTRIAL CAPITAL STUDY

($ 1949 millions)

	8000: Industry	7900: Institutions	Total	National Accounts	Total = (3) ÷ (4)	Comparison ratios: Construction	Comparison ratios: Machinery and equipment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1926	773	62	835	818	1.02	1.09	.96
1927	1000	74	1074	1039	1.03	1.11	.96
1928	1257	76	1333	1295	1.03	1.08	.97
1929	1440	85	1524	1491	1.02	1.07	.97
1930	1170	102	1271	1223	1.04	1.21	.97
1931	766	87	853	817	1.04	1.11	.95
1932	389	57	446	416	1.07	1.16	.97
1933	288	27	315	299	1.05	1.11	.99
1934	371	23	394	381	1.04	1.08	1.00
1935	449	25	474	476	1.00	1.07	.93
1936	555	34	589	585	1.01	1.08	.95
1937	740	38	778	776	1.00	1.06	.96
1938	701	47	748	741	1.01	1.10	.95
1939	651	52	703	702	1.00	1.09	.94
1940	874	30	904	971	.93	.96	.92
1941	1051	27	1077	1244	.87	.90	.85
1942	1028	23	1051	1202	.87	.84	.90
1943	666	27	693	915	.76	.55	1.02
1944	733	39	771	858	.90	.78	.99
1945	917	64	980	977	1.00	1.10	.95
1946	1251	98	1349	1362	.99	1.09	.92
1947	1799	106	1905	1915	1.00	1.07	.95
1948	2059	152	2211	2152	1.03	1.08	1.00
1949	2132	190	2322	2226	1.04	1.10	1.00
1950	2171	198	2369	2287	1.04	1.10	.99
1951	2483	201	2684	2555	1.05	1.10	1.01
1952	2804	224	3028	2849	1.06	1.10	1.04
1953	2950	230	3180	3012	1.05	1.09	1.03
1954	2706	257	2963	2768	1.06	1.12	1.03
1955	2665	305	2970	2922	1.01	1.13	.93

Table 6A. 2

RECONCILIATION OF THREE MEASURES OF INDUSTRIAL INVESTMENT, 1949

($ millions)

Private and Public Investment in Canada, 1926-1951		
PPI T 6 Business	1769	
PPI T 6 Government-owned enterprise	361	
"Industry" *Total*		2130
National Accounts—Income and Expenditure, 1926-1950		
NA T 2 Non-residential construction	903	
NA T 2 Machinery and equipment	1323	
"Non-government" *Total*	2226	
Less:		
PPI T 76 Churches	—33	
PPI T 77 Universities	—12	
PPI T 79 —81 Hospitals (private and municipal)	—50	
"Private institutions" *Total*	—95	
"Industry" *Total*	2131	
Industrial Capital Study		
No. 8000 Industry *Total*	2132	
Nos. 3380, 4381 Chemical products adjustment	—2	
"Industry" *Total*		2130

Table 6A. 1 shows in column 1 our constant-dollar estimates of investment by industry. In column 2 our estimates of investment by institutions are given, and the total of the two is in column 3. In column 4 the constant-dollar machinery and equipment and construction expenditures as shown in the National Accounts are presented in 1949 dollars.

The next three columns compare our estimates with those in the National Accounts. It will be seen that, apart from the war years, the difference ranges from —1% to +9%. This difference arises from the combination of the

three causes listed above. As suggested in the discussion of the estimates for 1949, the whole discrepancy of that year can be accounted for by the inclusion in the National Accounts non-residential construction category of the private institutions and the exclusion of the public institutions. It is probable that in the depression, 1931 to 1938 or 1939, a large part of the discrepancy is due to the use of different deflators and different weighting systems.

This source of difference is also present in the war years where the large negative discrepancy is ascribable only to the use of different deflators. (It should be mentioned that in the years 1942 to 1944 the National Accounts investment figures have been adjusted—as shown in Table 4. 1 therein—to exclude the United States investment in the wartime "Canol" project. This project has also been excluded from our estimates.)

The items in columns 6 and 7 show the discrepancy for construction and for machinery and equipment, respectively. It will be seen that by far the greatest part of the wartime discrepancy occurs in the construction estimates. It will also be noticed that over the whole period the discrepancy arises mostly in the construction estimates. This is to be expected, since most of the "public" institutional investment is in construction rather than in machinery.

Another approach to the reconciliation problem can be explained with the help of Table 6A. 3, which follows. The two totals which are to be reconciled are the constant-dollar investment totals from the National Accounts, and the constant-dollar investment totals from this industrial capital study. In the following table the National Accounts figures are referred to as NA and our own figures as ICS (industrial capital study).

The discrepancy to be explained, therefore, is that shown in column 3. (It should be noted that the figures for 1926 to 1932 have been adjusted in both ICS and NA.) A glance at the ratio for 1949 shows that ICS was approximately 96% (95.9) of NA, and that during the '20's and '30's the ratio did not diverge far from this percentage. What divergence there is can be explained by the use of different deflators; different deflators weighting; and the changing importance of the so-called private institutions included in NA, but excluded from ICS.

That this is the case can be shown by reference to column 4, which presents the same ratio, except that it is stated in current dollars. It will be seen that the two series move well together, except during the war.

The war, however, presents very complex problems of reconciliation. In column 3 the ratio rises well above 100%. The greater part of this excess is to be explained by the exclusion from the National Accounts of federal government shipping investments. That this is so is shown by column 4,

where current dollar items for *PPI* also rise well above the National Accounts total. This exclusion from the National Accounts is not referred to in the National Accounts (see page 110). However, it is noted in *PPI*, page 218 (schedule A).

Table 6A. 3

	Constant Dollars			Current Dollars
	1	2	3	4
	P.P.I./NA (a)	PPI/ICS	ICS/NA (b)	PPI/NA (a)
1926	113.4		98.0	97.3
1927	113.7		96.7	97.5
1928	114.4		97.1	98.1
1929	114.5		97.8	98.3
1930	112.9		96.2	97.2
1931	110.5		95.8	95.6
1932	111.9		93.3	95.5
1933	113.4	85.0	94.9	96.3
1934	116.3	83.7	96.7	97.1
1935	117.2	80.5	100.4	98.1
1936	116.9	81.3	99.3	97.9
1937	114.8	83.1	99.7	98.1
1938	116.7	81.0	99.1	97.5
1939	114.5	81.0	99.9	96.7
1940	109.6	82.1	107.4	94.2
1941	100.7	83.9	115.5	89.2
1942	102.7	83.2	114.4	93.9
1943	109.4	66.5	132.0	101.2
1944	124.7	68.5	111.3	115.6
1945	110.1	85.2	99.7	104.6
1946	99.7	92.1	100.7	96.6
1947	98.5	95.4	100.5	97.2
1948	95.4	100.3	97.3	96.1
1949	95.7	100.1	95.9	95.7
1950			96.5	

NOTES:

PPI: "Business" plus "Government-owned enterprises", "Constant dollar": as deflated in *PPI*, T 7, converted to 1949=100.

NA: National Accounts "Non-residential construction" plus "Machinery and equipment" (converted to 1949 dollars in columns 1 and 3).

ICS: Industrial Capital Study deflated investment series.

(a) *PPI* and NA not adjusted, 1926-32.

(b) ICS and NA both adjusted, 1926-32.

Columns 1 and 2, in effect, provide a commentary upon the different methods of deflation employed in *PPI*, ICS and NA. The deflation, the result of which is to be seen in Table VII of *PPI* was carried out prior to that shown in the National Accounts and by different weighting methods. A comparison of column 1 and column 3, however, shows that while the underlying investment data in current dollars are (apart from the war) very similar (see column 4), the deflators used in *PPI* were such as to overestimate the

price increase of capital goods which has taken place since 1929. The first year in which a comparison is possible between our own new estimates and *PPI* is 1933. In column 2 we show that in 1922 the deflation of *PPI* brought that figure to only 85% of our own ICS. This discrepancy, however, disappears by 1948 and in 1948 and 1949 the two series have come together (both excluding privately owned institutions).

Chapter 6, Appendix B

TABLES

THE FOLLOWING pages present in tables the results of the computing operations described in Chapter 6 and Appendix C of this chapter. An analytic table of contents follows:

Table 6B. 1. This table presents the results of the deflation of investment expenditures described in columns 5 and 6 of Appendix C. It should be emphasized that these figures are in 1949 dollars; with the exceptions noted in Appendix C they are based on data on new investment in *PPI,* 1926-55.

Pages 409 to 424

Table 6B. 2. This table shows the gross stock of fixed capital in 1949 prices by industry and by sector, 1926-55.

Pages 425 to 434

Table 6B. 3. This table shows the net stock of fixed capital in 1949 prices by industry and by sector, 1926-55.

Pages 435 to 444

Table 6B. 4. This table shows the investment in 1949 prices in social capital, 1926-55. The table distinguishes between government, institutions and housing, and between construction and machinery and equipment.

Pages 445 to 446

Table 6B. 5. This table shows the gross stock of social capital in 1949 prices by sector and by type of asset, 1926-55.

Pages 447 to 448

Table 6B. 6. This table shows the net stock of social capital in 1949 prices by sector and by type of asset, 1926-55.

Pages 449 to 450

Table 6B. 7. This table shows the gross and net stock in current and in 1949 prices obtained by direct cumulation of the investment data in industry as described for 8002 in Appendix C, 1926-55.

Pages 451 to 452

Table 6B. 8. This table shows investment expenditure and gross and net stock in 1949 prices for total manufacturing, as described in 4400 in Appendix C, 1926-55.

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Table 6B. 9. This table shows capital-output ratios calculated from the gross stock shown in Table 7, and the G.D.P. shown in Chapter 5 for industry, in 1949 prices, 1926-55.

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Table 6B. 1

INVESTMENT IN CONSTRUCTION AND MACHINERY AND EQUIPMENT BY INDUSTRY AND BY SECTOR, IN 1949 PRICES, 1926-55

1000 : Agriculture

	Construction	Machinery and equipment	Total
1926......	32.7	111.6	144.3
1927......	33.3	143.6	176.9
1928......	36.5	186.8	223.3
1929......	33.0	162.6	195.6
1930......	22.3	117.8	140.1
1931......	16.1	44.4	60.5
1932......	9.4	39.2	48.6
1933......	6.9	26.8	33.7
1934......	10.2	51.7	61.9
1935......	12.1	57.4	69.5
1936......	15.6	72.5	88.1
1937......	18.3	102.6	120.9
1938......	17.4	103.5	120.9
1939......	20.5	97.7	118.2
1940......	21.5	124.0	145.5
1941......	25.3	128.3	153.6
1942......	23.2	98.8	122.0
1943......	23.2	53.4	76.6
1944......	30.7	98.1	128.8
1945......	36.0	124.3	160.3
1946......	47.8	176.4	224.2
1947......	48.3	268.3	316.6
1948......	52.7	307.2	359.9
1949......	51.2	350.4	401.6
1950......	55.0	372.2	427.2
1951......	58.0	351.9	409.9
1952......	63.7	364.3	428.0
1953......	64.9	354.4	419.3
1954......	59.7	234.8	294.5
1955......	60.1	260.3	320.4

Table 6B. 1 (Cont'd.)

2000 : Resource Industries

	2080 : Forestry			2091 : Fishing	2100 : Mining, quarrying and oil wells		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1926	5.1	5.3	10.4	13.4	14.5	13.4	27.9
1927	5.3	5.5	10.8	13.8	14.5	16.3	30.8
1928	5.3	5.9	11.2	9.2	33.6	20.1	53.7
1929	5.3	5.8	11.1	14.0	41.8	32.7	74.5
1930	4.9	5.4	10.3	9.7	52.5	24.6	77.1
1931	3.3	3.6	6.9	5.7	28.8	11.4	40.2
1932	2.1	2.1	4.2	6.8	6.2	7.4	13.6
1933	2.3	2.3	4.6	9.7	10.3	6.1	16.4
1934	2.7	2.9	5.6	10.4	10.0	11.3	21.3
1935	3.0	3.0	6.0	9.0	45.8	11.9	57.7
1936	3.6	3.7	7.3	10.4	38.6	17.1	55.7
1937	4.0	4.3	8.3	8.3	29.4	24.7	54.1
1938	3.7	3.9	7.6	8.2	32.9	23.5	56.4
1939	4.0	4.3	8.3	7.3	28.2	23.6	51.8
1940	5.1	5.2	10.3	8.3	22.2	23.9	46.1
1941	2.7	8.6	11.3	9.2	23.3	24.2	47.5
1942	4.5	6.2	10.7	9.5	13.8	16.7	30.5
1943	4.2	4.5	8.7	9.9	11.1	10.0	21.1
1944	11.8	7.2	19.0	13.1	12.0	10.9	22.9
1945	8.7	8.4	17.1	17.0	13.6	8.0	21.6
1946	8.5	10.1	18.6	18.5	32.6	18.1	50.7
1947	18.3	21.1	39.4	21.6	36.1	46.3	82.4
1948	14.7	14.9	29.6	21.3	56.4	52.8	109.2
1949	16.0	10.0	26.0	18.0	68.0	54.0	122.0
1950	16.3	15.8	32.1	23.5	68.4	42.4	110.8
1951	19.5	30.4	49.9	25.3	89.6	61.7	151.3
1952	15.8	16.7	32.5	25.0	108.4	61.9	170.3
1953	15.3	12.2	27.5	19.0	124.1	76.1	200.2
1954	21.3	16.2	37.5	16.3	136.8	78.8	215.6
1955	28.0	20.7	48.7	16.7	154.0	65.2	219.2

Table 6B. 1 (Cont'd.)

2000 : Resource Industries (Cont'd.)

	2602 : Central electric stations and gas works			Total resource industries		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	43.8	22.0	65.8	63.4	40.7	104.1
1927	43.7	28.5	72.2	63.5	50.3	113.8
1928	60.9	35.0	95.9	99.8	61.0	160.8
1929	77.6	35.8	113.4	124.7	74.3	199.0
1930	109.0	38.5	147.5	166.4	68.5	234.9
1931	110.4	26.4	136.8	142.5	41.4	183.9
1932	58.1	17.4	75.5	66.4	33.7	100.1
1933	21.6	8.4	30.0	34.2	26.5	60.7
1934	24.7	9.1	33.8	37.4	33.7	71.1
1935	27.6	12.0	39.6	76.4	35.9	112.3
1936	19.2	12.9	32.1	61.4	44.1	105.5
1937	26.0	21.9	47.9	59.4	59.2	118.6
1938	34.9	21.5	56.4	71.5	57.1	128.6
1939	32.6	17.7	50.3	64.8	52.9	117.7
1940	34.3	17.0	51.3	61.6	54.4	116.0
1941	63.1	26.1	89.2	89.1	68.1	157.2
1942	73.0	31.4	104.4	91.3	63.8	155.1
1943	33.1	14.9	48.0	48.4	39.3	87.7
1944	15.8	9.7	25.5	39.6	40.9	80.5
1945	37.0	6.1	43.1	59.3	39.5	98.8
1946	74.2	14.0	88.2	115.3	60.7	176.0
1947	94.0	44.2	138.2	148.4	133.2	281.6
1948	169.0	71.3	240.3	240.1	160.3	400.4
1949	228.1	91.8	319.9	312.1	173.8	485.9
1950	242.7	76.6	319.3	327.4	158.3	485.7
1951	261.2	93.0	354.2	370.3	210.4	580.7
1952	308.3	123.1	431.4	432.5	226.7	659.2
1953	259.4	128.5	387.9	398.8	235.8	634.6
1954	224.4	103.2	327.6	382.5	214.5	597.0
1955	219.7	83.8	303.5	401.7	186.4	588.1

Table 6B. 1 (Cont'd.)

3000 : Primary Manufacturing Industries

	3200 : Food and beverages			3281 : Wood and its products			3294 : Pulp and paper		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	1.6	6.3	7.9	3.3	5.1	8.4	30.7	33.0	63.7
1927	2.6	6.8	9.4	21.3	7.6	28.9	35.5	36.1	71.6
1928	5.6	7.4	13.0	7.2	4.6	11.8	45.1	26.4	71.5
1929	7.6	9.8	17.4	9.6	3.4	13.0	21.8	14.4	36.2
1930	4.2	8.0	12.2	5.7	5.4	11.1	6.4	32.9	39.3
1931	4.4	4.3	8.7	1.0	2.9	3.9	17.8	3.1	20.9
1932	3.1	2.3	5.4	4.7	1.9	6.6	3.4	2.0	5.4
1933	0.5	1.5	2.0	7.9	1.9	9.8	0.2	1.2	1.4
1934	1.1	2.7	3.8	4.9	1.5	6.4	1.3	4.6	5.9
1935	2.3	4.0	6.3	1.1	2.8	3.9	3.5	4.0	7.5
1936	3.5	4.1	7.6	3.1	1.9	5.0	3.2	6.0	8.3
1937	5.3	7.2	12.5	14.8	4.1	18.9	5.8	9.3	15.1
1938	4.9	8.1	13.0	1.3	3.0	4.3	3.7	6.9	10.6
1939	4.8	7.4	12.2	5.2	2.0	7.2	5.7	3.3	9.0
1940	6.5	7.1	13.6	8.2	3.1	11.3	7.1	13.8	20.9
1941	5.6	7.1	12.7	10.4	5.8	16.2	11.7	7.5	19.2
1942	4.6	5.4	10.0	10.2	3.7	13.9	4.7	12.2	16.9
1943	3.1	4.0	7.1	14.4	3.2	17.6	2.0	6.3	8.3
1944	5.4	5.7	11.1	2.4	2.1	4.5	9.4	8.2	17.6
1945	9.1	8.7	17.8	1.3	3.3	4.6	6.9	13.2	20.1
1946	17.2	18.4	35.6	8.7	9.0	17.7	30.1	32.4	62.5
1947	14.3	26.6	40.9	8.2	17.9	26.1	30.4	50.7	81.1
1948	11.9	28.2	40.1	5.0	14.7	19.7	25.3	54.3	79.6
1949	10.1	25.1	35.2	4.5	14.4	18.9	22.8	46.5	69.3
1950	7.6	19.0	26.6	4.7	14.6	19.3	16.8	45.5	62.3
1951	8.2	20.9	29.1	5.8	17.4	23.2	29.6	58.3	87.9
1952	8.2	22.6	30.8	4.5	15.1	19.6	22.1	65.5	87.6
1953	6.6	22.0	28.6	4.8	15.7	20.5	14.2	54.1	68.3
1954	10.8	25.3	36.1	3.9	15.7	19.6	13.7	43.3	57.0
1955	8.0	19.8	27.8	4.6	15.8	20.4	19.5	65.4	84.9

Table 6B. 1 (Cont'd.)

3000 : Primary Manufacturing Industries (Cont'd.)

	3345 : Non-ferrous metals and electrical equipment			3361 : Non-metallic mineral products and products of petroleum and coal			3380 : Chemical products		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926..........	2.5	3.4	5.9	1.0	0.6	1.6	4.0	1.2	5.2
1927..........	1.9	3.0	4.9	1.0	1.1	2.1	2.3	3.1	5.4
1928..........	1.4	3.1	4.5	4.9	1.1	6.0	1.1	2.3	3.4
1929..........	3.2	3.7	6.9	4.8	1.3	6.1	9.4	4.5	13.9
1930..........	1.7	6.0	7.7	4.2	1.3	5.5	2.6	3.2	5.8
1931..........	1.0	3.7	4.7	1.4	1.3	2.7	1.8	2.0	3.8
1932..........	0.6	2.4	3.0	0.4	0.6	1.0	0.7	0.9	1.6
1933..........	0.5	0.8	1.3	0.4	0.5	0.9	1.0	2.5	3.5
1934..........	0.6	1.1	1.7	0.6	0.5	1.1	2.5	1.5	4.0
1935..........	0.9	1.4	2.3	0.6	0.5	1.1	1.1	1.8	2.9
1936..........	0.8	2.2	3.0	0.6	0.5	1.1	0.4	2.1	2.5
1937..........	0.8	6.4	7.2	1.0	0.6	1.6	4.7	1.8	6.5
1938..........	1.3	5.4	6.7	0.8	0.7	1.5	2.6	3.0	5.6
1939..........	0.4	4.8	5.2	0.7	0.8	1.5	0.9	2.1	3.0
1940..........	15.3	4.9	20.2	1.0	0.8	1.8	1.7	3.5	5.2
1941..........	23.9	10.4	34.3	0.8	0.9	1.7	2.7	6.2	8.9
1942..........	50.8	8.4	59.2	0.5	0.9	1.4	4.2	3.2	7.4
1943..........	29.8	3.2	33.0	0.5	0.9	1.4	1.9	2.0	3.9
1944..........	11.9	3.2	15.1	0.4	0.7	1.1	1.0	1.1	2.1
1945..........	1.2	4.9	6.1	1.0	1.2	2.2	3.0	2.6	5.6
1946..........	4.0	8.0	12.0	0.5	1.1	1.6	7.2	2.2	9.4
1947..........	4.5	4.5	9.0	2.9	4.9	7.8	2.7	7.6	10.3
1948..........	7.7	10.5	18.2	4.3	6.0	10.3	6.6	14.4	21.0
1949..........	7.0	7.5	14.5	2.8	4.6	7.4	6.9	12.2	19.1
1950..........	6.4	8.6	15.0	1.0	2.9	3.9	3.6	8.0	11.6
1951..........	17.4	16.8	34.2	4.4	7.8	12.2	4.5	13.3	17.8
1952..........	25.6	27.0	52.6	5.1	10.0	15.1	37.3	50.0	87.3
1953..........	25.3	29.6	54.9	2.4	5.1	7.5	18.9	66.2	85.1
1954..........	15.3	26.0	41.3	7.1	8.1	15.1	2.2	9.5	11.7
1955..........	21.2	22.1	43.3	6.2	10.7	16.9	4.1	18.6	22.7

Table 6B. 1 (Cont'd.)

3000 : *Primary Manufacturing Industries (Cont'd.)*

	Capital items charged to operating expenses	Total primary manufacturing		
	Total	Construction	Machinery and equipment	Total
1926	12.3	43.1	61.9	105.0
1927	14.5	64.6	72.2	136.8
1928	11.5	65.3	56.4	121.7
1929	9.5	56.4	46.6	103.0
1930	14.2	24.8	71.0	95.8
1931	4.7	27.4	22.0	49.4
1932	2.9	12.9	13.0	25.9
1933	1.6	10.5	10.0	20.5
1934	2.5	11.0	14.4	25.4
1935	4.0	9.5	18.5	28.0
1936	4.6	10.7	21.4	32.1
1937	8.0	32.4	37.4	69.8
1938	7.6	14.6	34.7	49.3
1939	5.9	17.7	26.3	44.0
1940	44.8	39.8	78.0	117.8
1941	52.8	55.1	90.7	145.8
1942	46.2	75.0	80.0	155.0
1943	26.0	51.7	45.6	97.3
1944	27.7	30.5	48.7	79.2
1945	44.2	22.5	78.1	100.6
1946	19.3	67.7	90.4	158.1
1947	22.5	63.0	134.7	197.7
1948	24.6	60.8	152.7	213.5
1949	21.7	54.2	131.9	186.1
1950	21.0	40.1	119.6	159.7
1951	26.7	69.9	161.2	231.1
1952	34.1	102.8	224.3	327.1
1953	34.3	72.2	227.0	299.2
1954	25.3	53.0	153.2	206.2
1955	29.7	63.6	182.1	245.7

Table 6B. 1 (Cont'd.)

4000 : Secondary Manufacturing

	4218 : Food and beverages			4230 : Rubber, leather and tobacco			4251 : Textiles		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926..........	2.8	7.2	10.0	1.3	2.1	3.4	7.7	3.8	11.5
1927..........	4.6	7.7	12.3	1.8	5.5	7.3	10.1	11.8	21.9
1928..........	9.8	8.3	18.1	4.7	4.7	9.4	1.0	12.8	13.8
1929..........	13.5	11.0	24.5	4.0	5.7	9.7	2.2	7.3	9.5
1930..........	7.5	9.0	16.5	3.4	3.7	7.1	10.8	5.3	16.1
1931..........	7.7	4.8	12.5	1.6	2.2	3.8	2.8	17.8	20.6
1932..........	5.6	2.6	8.2	0.7	1.7	2.4	1.8	4.3	6.1
1933..........	1.0	1.7	2.7	5.5	2.4	7.9	1.7	5.8	7.5
1934..........	1.9	3.1	5.0	0.8	2.4	3.2	1.1	7.6	8.7
1935..........	4.1	4.6	8.7	0.2	3.0	3.2	5.1	11.4	16.5
1936..........	6.1	4.6	10.7	29.7	8.5	38.2	2.4	8.4	10.8
1937..........	9.4	8.2	17.6	3.0	3.5	6.5	4.5	9.1	13.6
1938..........	8.7	9.1	17.8	1.4	3.6	5.0	2.4	7.3	9.7
1939..........	8.4	8.3	16.7	1.9	2.8	4.7	1.1	7.1	8.2
1940..........	11.5	7.9	19.4	4.5	2.8	7.3	5.7	12.3	18.0
1941..........	9.8	8.0	17.8	3.8	2.9	6.7	4.9	9.3	14.2
1942..........	8.0	6.1	14.1	3.5	1.9	5.4	2.2	5.2	7.4
1943..........	5.5	4.5	10.0	3.1	1.8	4.9	1.1	1.9	3.0
1944..........	9.5	6.5	16.0	3.2	2.9	6.1	2.5	5.2	7.7
1945..........	16.1	9.8	25.9	8.2	5.0	13.2	1.8	8.8	10.6
1946..........	15.2	15.8	31.0	8.7	7.3	16.0	11.0	19.5	30.5
1947..........	25.0	30.2	55.2	5.4	13.6	19.0	13.0	29.3	42.3
1948..........	21.6	32.0	53.6	3.6	9.2	12.8	6.8	31.0	37.8
1949..........	17.6	25.9	43.5	2.6	8.5	11.1	7.0	25.1	32.1
1950..........	17.3	25.8	43.1	2.2	6.8	9.0	6.3	18.9	25.2
1951..........	15.6	22.3	37.9	2.9	8.0	10.9	8.4	24.7	33.1
1952..........	13.0	23.5	36.5	3.0	9.8	12.8	5.6	22.3	27.9
1953..........	13.5	29.7	43.2	4.5	13.6	18.1	6.1	17.5	23.6
1954..........	18.9	26.4	45.3	4.3	13.4	17.7	5.3	17.7	23.0
1955..........	18.3	23.9	42.2	3.7	14.0	17.7	4.4	11.7	16.1

Table 6B. 1 (Cont'd.)

4000 : Secondary Manufacturing (Cont'd.)

	4270 : Clothing			4286 : Wood products			4292 : Pulp and paper		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	3.3	2.3	5.6	2.1	1.7	3.8	5.4	5.8	11.2
1927	12.2	2.7	14.9	13.8	2.5	16.3	6.3	6.4	12.7
1928	17.4	2.4	19.8	4.7	1.5	6.2	8.0	4.7	12.7
1929	20.8	3.5	24.3	6.3	1.1	7.4	3.8	2.5	6.3
1930	1.3	1.7	3.0	3.7	1.8	5.5	1.1	5.8	6.9
1931	2.7	1.0	3.7	0.7	1.0	1.7	3.1	0.6	3.7
1932	2.3	0.8	3.1	3.1	0.6	3.7	0.6	0.4	1.0
1933	2.1	1.0	3.1	5.2	0.6	5.8	0.0	0.2	0.2
1934	0.7	1.3	2.0	3.2	0.5	3.7	0.2	0.8	1.0
1935	0.2	1.1	1.3	0.7	0.9	1.6	0.6	0.7	1.3
1936	1.4	1.7	3.1	2.0	0.6	2.6	0.4	1.1	1.5
1937	3.1	2.3	5.4	9.6	1.4	11.0	1.0	1.6	2.6
1938	0.7	1.5	2.2	0.8	1.0	1.8	0.7	1.2	1.9
1939	2.5	2.7	5.2	3.4	0.7	4.1	1.0	0.6	1.6
1940	4.0	2.1	6.1	5.3	1.0	6.3	1.3	2.4	3.7
1941	17.3	2.3	19.6	6.8	1.9	8.7	2.1	1.3	3.4
1942	4.5	1.2	5.7	6.6	1.2	7.8	0.8	2.2	3.0
1943	2.3	1.3	3.6	9.3	1.1	10.4	0.4	1.1	1.5
1944	3.9	1.2	5.1	1.6	0.7	2.3	1.7	1.4	3.1
1945	12.7	5.0	17.7	0.9	1.1	2.0	1.2	2.3	3.5
1946	3.4	7.0	10.4	5.6	3.0	8.6	5.3	5.7	11.0
1947	4.4	11.7	16.1	5.4	6.0	11.4	5.4	9.0	14.4
1948	2.2	10.9	13.1	3.3	4.9	8.2	4.5	9.6	14.1
1949	3.0	10.7	13.7	3.0	4.8	7.8	4.0	8.2	12.2
1950	2.4	8.6	11.0	3.0	4.9	7.9	3.0	8.0	11.0
1951	3.5	7.7	11.2	3.7	5.8	9.5	5.2	10.3	15.5
1952	1.3	10.1	11.4	2.9	5.0	7.9	3.9	11.6	15.5
1953	2.9	9.3	12.2	3.2	5.2	8.4	2.5	9.6	12.1
1954	1.7	6.6	8.3	2.6	5.2	7.8	2.4	7.6	10.0
1955	1.4	5.6	7.0	3.0	5.3	8.3	3.4	11.5	14.9

Table 6B. 1 (Cont'd.)

4000 : Secondary Manufacturing (Cont'd.)

	4301 : Printing, publishing and allied industries			4311 : Iron and steel products			4330 : Transportation equipment		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	1.3	6.2	7.5	5.9	6.3	12.2	1.3	1.7	3.0
1927	0.8	5.3	6.1	8.3	7.3	15.6	7.8	4.5	12.3
1928	15.1	11.0	26.1	7.8	12.0	19.8	11.3	9.9	21.2
1929	11.7	13.0	24.7	13.1	15.6	28.7	13.0	8.8	21.8
1930	0.3	7.7	8.0	20.5	8.5	29.0	2.9	5.6	8.5
1931	0.5	4.7	5.2	8.3	8.6	16.9	0.5	4.2	4.7
1932	1.2	3.3	4.5	0.9	2.8	3.7	0.4	3.4	3.8
1933	0.6	14.4	15.0	1.1	2.1	3.2	1.1	2.7	3.8
1934	—	14.2	14.2	4.7	4.1	8.8	3.9	2.1	6.0
1935	1.1	8.8	9.9	4.5	4.5	9.0	4.4	4.6	9.0
1936	—	2.7	2.7	5.6	4.8	10.4	1.6	3.9	5.5
1937	2.1	4.0	6.1	16.8	13.0	29.8	9.0	7.8	16.8
1938	1.0	4.7	5.7	8.5	8.1	16.6	25.3	9.2	34.5
1939	0.5	8.1	8.6	7.4	7.9	15.3	5.1	6.4	11.5
1940	1.0	5.1	6.1	8.2	20.6	28.8	5.7	9.6	15.3
1941	—	2.8	2.8	15.6	39.8	55.4	4.8	9.5	14.3
1942	0.4	2.1	2.5	10.6	45.5	56.1	41.5	18.4	59.9
1943	0.3	1.3	1.6	6.1	28.3	34.4	9.3	14.1	23.4
1944	0.3	2.4	2.7	14.0	26.4	40.4	2.2	4.9	7.1
1945	5.4	2.4	7.8	17.7	23.0	40.7	3.0	9.7	12.7
1946	3.8	5.3	9.1	19.4	27.9	47.3	7.1	12.2	19.3
1947	6.4	9.6	16.0	18.7	44.9	63.6	6.2	10.1	16.3
1948	7.4	13.2	20.6	20.3	38.8	59.1	5.7	10.6	16.3
1949	6.3	13.8	20.1	14.6	37.7	52.3	6.7	15.3	22.0
1950	4.8	13.1	17.9	12.8	27.8	40.6	9.5	15.4	24.9
1951	5.4	15.2	20.6	39.7	41.7	81.4	18.6	22.1	40.7
1952	2.6	10.0	12.6	36.3	77.3	113.6	29.6	21.5	51.1
1953	2.9	10.5	13.4	26.9	65.3	92.2	36.1	41.8	77.9
1954	9.0	17.2	26.2	16.7	54.8	71.5	16.2	36.5	52.7
1955	5.0	15.7	20.7	20.0	51.7	71.7	15.1	28.8	43.9

Table 6B. 1 (Cont'd.)

4000 : Secondary Manufacturing (Cont'd.)

	4341 : Non-ferrous metals and electric equipment			4362 : Non-metallic mineral and petroleum and coal products			4381 : Chemical products		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926..........	1.8	3.9	5.7	10.3	2.6	12.9	3.4	0.8	4.2
1927..........	1.3	3.3	4.6	9.6	4.2	13.8	1.9	2.2	4.1
1928..........	1.0	3.4	4.4	48.5	4.3	52.8	0.9	1.6	2.5
1929..........	2.3	4.1	6.4	47.6	5.2	52.8	8.1	3.2	11.3
1930..........	1.3	6.8	8.1	41.9	5.0	46.9	2.3	2.2	4.5
1931..........	0.8	4.2	5.0	13.8	5.0	18.8	1.5	1.4	2.9
1932..........	0.5	2.7	3.2	3.6	2.5	6.1	0.6	0.6	1.2
1933..........	0.3	0.8	1.1	3.5	1.8	5.3	0.9	1.7	2.6
1934..........	0.5	1.3	1.8	5.8	2.2	8.0	2.1	1.0	3.1
1935..........	0.6	1.5	2.1	6.1	2.0	8.1	0.9	1.3	2.2
1936..........	0.5	2.4	2.9	5.9	1.8	7.7	0.3	1.5	1.8
1937..........	0.5	7.2	7.7	10.3	2.3	12.6	4.1	1.2	5.3
1938..........	0.9	6.0	6.9	8.1	2.6	10.7	2.3	2.1	4.4
1939..........	0.3	5.5	5.8	6.8	3.0	9.8	0.8	1.5	2.3
1940..........	10.9	5.5	16.4	9.5	3.3	12.8	1.4	2.5	3.9
1941..........	17.2	11.8	29.0	7.5	3.6	11.1	2.3	4.4	6.7
1942..........	36.4	9.4	45.8	5.2	3.5	8.7	3.6	2.2	5.8
1943..........	21.3	3.7	25.0	4.6	3.6	8.2	1.6	1.5	3.1
1944..........	8.5	3.5	12.0	4.4	2.6	7.0	0.9	0.7	1.6
1945..........	0.9	5.6	6.5	9.9	4.8	14.7	2.6	1.8	4.4
1946..........	2.9	8.9	11.8	10.8	10.8	21.6	7.9	7.9	15.8
1947..........	9.5	17.3	26.8	36.8	19.7	56.5	13.8	14.4	28.2
1948..........	6.4	20.1	26.5	37.1	26.1	63.2	8.7	14.3	23.0
1949..........	8.2	22.8	31.0	22.2	17.9	40.1	5.5	14.9	20.4
1950..........	5.0	13.3	18.3	16.5	25.4	41.9	3.6	9.9	13.5
1951..........	15.2	18.4	33.6	23.2	40.2	63.4	11.3	20.4	31.7
1952..........	19.1	22.3	41.4	35.4	41.4	76.8	10.0	23.5	33.5
1953..........	15.1	24.7	39.8	51.6	29.4	81.0	5.0	13.4	18.4
1954..........	25.1	20.3	45.4	66.6	23.2	89.8	8.6	12.7	21.3
1955..........	19.8	24.8	44.6	77.3	16.8	94.1	14.7	11.6	26.3

Table 6B. 1 (Cont'd.)

4000 : *Secondary Manufacturing (Cont'd.)*

	4391: Miscellaneous manufacturing			Capital items charged to operating expenses	Total secondary manufacturing		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1926	2.0	1.6	3.6	11.1	48.6	57.1	105.7
1927	3.1	2.0	5.1	16.0	81.7	81.4	163.1
1928	4.3	2.0	6.3	19.7	134.6	98.3	232.9
1929	4.5	2.0	6.5	20.9	150.9	103.9	254.8
1930	2.7	1.9	4.6	15.7	99.6	80.7	180.3
1931	1.5	1.3	2.8	14.8	45.5	71.6	117.1
1932	0.7	0.5	1.2	7.2	21.9	33.4	55.3
1933	0.7	0.5	1.2	7.0	23.7	42.7	66.4
1934	0.7	0.7	1.4	8.6	25.6	49.9	75.5
1935	0.9	1.1	2.0	12.4	29.4	57.9	87.3
1936	1.4	1.1	2.5	11.7	57.4	54.8	112.2
1937	2.4	1.6	4.0	17.0	75.8	80.2	156.0
1938	1.7	1.5	3.2	15.9	62.4	73.8	136.2
1939	1.2	1.5	2.7	15.8	40.4	71.9	112.3
1940	2.5	2.1	4.6	103.0	71.6	180.2	251.8
1941	3.3	2.7	6.0	138.3	95.4	238.1	333.5
1942	4.5	2.6	7.1	137.9	127.8	239.4	367.2
1943	2.7	1.6	4.3	86.2	67.7	152.0	219.7
1944	1.8	1.6	3.4	78.8	54.4	138.8	193.2
1945	2.4	2.2	4.6	104.5	82.7	186.0	268.7
1946	3.8	3.6	7.4	36.0	105.0	170.9	275.9
1947	2.7	4.0	6.7	43.1	152.7	262.9	415.6
1948	2.8	4.0	6.8	40.8	130.4	265.5	395.9
1949	2.3	3.6	5.9	39.2	103.0	248.4	351.4
1950	2.3	3.3	5.6	34.6	88.7	215.8	304.5
1951	2.6	3.7	6.3	40.8	155.4	281.3	436.7
1952	3.8	3.5	7.3	43.9	166.6	325.7	492.3
1953	2.9	4.2	7.1	44.2	173.1	318.4	491.5
1954	2.1	3.7	5.8	44.4	179.5	289.7	469.2
1955	3.5	5.3	8.8	42.7	189.6	269.4	459.0

Table 6B. 1 (Cont'd.)

5000 : Transport, Storage and Communication

	5508 : Steam railways			5510 : Electric railways			5547 : Telephones and broadcasting		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926..........	104.2	35.2	139.4	10.1	4.2	14.3	18.1	18.1	36.2
1927..........	128.6	60.9	189.5	9.0	6.0	15.0	19.9	20.1	40.0
1928..........	163.3	34.7	198.0	9.5	6.2	15.7	23.9	23.7	47.6
1929..........	196.6	108.8	305.4	9.0	9.5	18.5	29.9	30.7	60.6
1930..........	156.3	69.1	225.4	5.9	4.3	10.2	19.7	41.3	61.0
1931..........	123.7	46.6	170.3	7.2	2.3	9.5	13.7	32.0	45.7
1932..........	41.5	3.8	45.3	3.1	8.8	11.9	8.5	17.3	25.8
1933..........	24.1	4.7	28.8	2.1	1.1	3.2	4.7	15.2	19.9
1934..........	30.8	5.8	36.6	5.0	1.9	6.9	1.9	16.4	18.3
1935..........	35.6	7.6	43.2	2.4	1.3	3.7	1.1	19.0	20.1
1936..........	40.0	26.3	66.3	3.8	2.2	6.0	6.5	16.4	22.9
1937..........	37.9	66.9	104.8	3.7	2.5	6.2	9.3	21.6	30.9
1938..........	32.9	48.2	81.1	3.5	7.5	11.0	8.6	21.6	30.2
1939..........	35.8	35.7	71.5	1.7	2.6	4.3	10.6	24.4	35.0
1940..........	37.6	37.6	75.2	1.8	4.6	6.4	12.5	16.5	29.0
1941..........	45.9	21.5	67.4	1.3	4.4	5.7	3.0	23.2	26.2
1942..........	36.0	30.0	66.0	1.3	6.0	7.3	2.6	19.6	22.2
1943..........	31.0	39.4	70.4	1.8	2.0	3.8	3.0	12.1	15.1
1944..........	34.3	56.0	90.3	1.9	4.4	6.3	4.6	12.8	17.4
1945..........	33.1	31.7	64.8	2.0	3.7	5.7	17.6	13.5	31.1
1946..........	44.3	27.6	71.9	3.1	7.1	10.2	34.6	23.5	58.1
1947..........	32.4	64.2	96.6	7.0	18.9	25.9	42.7	50.4	93.1
1948..........	40.4	96.1	136.5	6.9	12.8	19.7	48.3	60.6	108.9
1949..........	53.9	81.3	135.2	5.7	13.3	19.0	52.7	64.6	117.3
1950..........	35.2	60.0	95.2	10.8	10.1	20.9	43.1	61.9	105.0
1951..........	51.9	125.9	177.8	14.2	6.7	20.9	45.1	62.7	107.8
1952..........	76.7	137.1	213.8	14.9	5.4	20.3	46.8	79.5	126.3
1953..........	85.8	152.8	238.6	10.3	13.2	23.5	55.5	86.1	141.6
1954..........	57.6	165.3	222.9	6.5	6.5	13.0	60.1	107.9	168.0
1955..........	53.8	94.3	148.1	5.1	9.0	14.1	60.2	109.0	169.2

Table 6B. 1 (Cont'd.)

5000 : Transport, Storage and Communication (Cont'd.)

	All other transport, storage and communication including capital items charged to operating expenses			Total transport, storage and communication		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	4.8	11.1	15.9	137.2	68.6	205.8
1927	2.8	13.5	16.3	160.3	100.5	260.8
1928	7.2	35.3	42.5	203.9	99.9	303.8
1929	10.9	29.2	40.1	246.4	178.2	424.6
1930	13.0	23.2	36.2	194.9	137.9	332.8
1931	6.7	18.6	25.3	151.3	99.5	250.8
1932	2.6	8.9	11.5	55.7	38.8	94.5
1933	2.1	4.3	6.4	33.0	25.3	58.3
1934	2.3	7.4	9.7	40.0	31.5	71.5
1935	2.8	9.0	11.8	41.9	36.9	78.8
1936	11.4	11.1	22.5	61.7	56.0	117.7
1937	9.7	12.1	21.8	60.6	103.1	163.7
1938	7.4	24.3	31.7	52.4	101.6	154,0
1939	6.4	15.2	21.6	54.5	77.9	132.4
1940	9.3	17.2	26.5	61.2	75.9	137.1
1941	9.2	13.7	22.9	59.4	62.8	122.2
1942	4.6	11.1	15.7	44.5	66.7	111.2
1943	3.1	19.1	11.4	38.9	72.6	111.5
1944	4.3	30.5	34.8	45.1	103.7	148.8
1945	8.6	22.2	30.8	61.3	71.1	132.4
1946	9.4	39.3	48.7	91.4	97.5	188.9
1947	16.6	50.4	67.0	98.7	183.9	282.6
1948	17.0	30.4	47.4	112.6	199.9	312.5
1949	23.0	43.7	66.7	135.3	202.9	338.2
1950	59.6	45.8	105.4	148.7	177.8	326.5
1951	20.1	50.1	70.2	131.3	245.4	376.7
1952	70.5	60.2	130.7	208.9	282.2	491.1
1953	73.7	68.8	142.5	225.3	320.9	546.2
1954	69.1	62.2	131.3	193.3	341.9	535.2
1955	54.2	62.3	116.5	173.3	274.6	447.9

Table 6B. 1 (Cont'd.)

6000 : Trade, Services and Construction

	6404 : Construction industry			6608 : Waterworks	6700 : Trade — wholesale and retail		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1926	3.3	23.1	26.4	5.3	24.5	10.3	34.8
1927	3.5	25.9	29.4	6.1	26.8	13.2	40.0
1928	5.7	42.6	48.3	6.7	50.6	23.4	74.0
1929	7.1	54.1	61.2	7.6	65.5	31.3	96.8
1930	6.4	47.1	53.5	7.9	43.1	19.1	62.2
1931	2.7	17.7	20.4	7.1	29.5	9.1	38.6
1932	1.1	6.5	7.6	6.9	20.4	5.8	26.2
1933	0.4	2.8	3.2	6.3	12.1	3.7	15.8
1934	0.6	3.9	4.5	5.1	21.4	8.0	29.4
1935	1.9	11.4	13.3	5.9	18.1	6.9	25.0
1936	1.8	11.5	13.3	6.0	22.3	8.9	31.2
1937	2.7	18.0	20.7	5.7	28.9	13.8	42.7
1938	2.2	14.0	16.2	6.2	34.7	18.2	52.9
1939	2.6	16.2	18.8	6.7	32.3	14.7	47.0
1940	2.8	15.9	18.7	4.5	30.6	19.0	49.6
1941	3.6	19.5	23.1	4.6	25.9	15.9	41.8
1942	5.0	27.7	32.7	4.1	28.1	15.6	43.7
1943	4.5	24.6	29.1	4.2	11.0	5.8	16.8
1944	3.6	20.4	24.0	3.9	25.6	19.8	45.4
1945	5.8	33.9	39.7	6.5	30.3	21.8	52.1
1946	6.0	37.4	43.4	11.0	62.0	40.9	102.9
1947	3.6	57.7	61.3	11.7	80.7	55.2	135.9
1948	8.3	54.4	62.7	14.4	99.9	68.6	168.5
1949	12.0	43.0	55.0	17.6	102.8	90.3	193.1
1950	13.2	52.3	65.5	24.9	116.2	103.8	220.0
1951	5.9	50.1	56.0	29.8	93.1	110.4	203.5
1952	3.9	60.7	64.6	35.6	76.2	94.4	170.6
1953	7.6	69.8	77.4	37.2	147.4	124.9	272.3
1954	6.8	75.2	82.0	45 1	168.9	123.9	292.8
1955	8.0	78.7	86.7	37.9	165.1	123.4	288.5

Table 6B. 1 (Cont'd.)

6000 : Trade, Services and Construction (Cont'd.)

	6800 : Finance, insurance and real estate			6920 : Commercial services			Total trade, services and construction including capital items charged to operating expenses		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	10.0	1.8	11.8	14.0	14.5	28.5	57.1	51.3	108.4
1927	17.6	3.5	21.1	32.1	17.6	49.7	86.1	62.1	148.2
1928	18.5	3.4	21.9	39.2	22.1	61.3	120.7	93.5	214.2
1929	24.7	4.6	29.3	40.8	24.4	65.2	145.7	116.8	262.5
1930	17.7	3.2	20.9	22.0	17.0	39.0	97.1	88.5	185.6
1931	15.7	2.2	17.9	8.7	9.6	18.3	63.7	40.3	104.0
1932	12.1	1.5	13.6	4.4	4.4	8.8	44.9	19.3	64.2
1933	8.2	1.1	9.3	7.1	5.6	12.7	34.1	14.1	48.2
1934	7.2	1.0	8.2	8.7	8.9	17.6	43.0	22.9	65.9
1935	6.9	1.0	7.9	9.5	10.4	19.9	42.3	30.8	73.1
1936	7.1	1.2	8.3	17.8	22.0	39.8	55.0	44.9	99.9
1937	7.8	1.5	9.3	12.5	18.7	31.2	57.6	53.6	111.2
1938	7.8	1.6	9.4	9.4	16.1	25.5	60.3	51.6	111.9
1939	10.5	0.9	11.4	17.2	24.1	41.3	69.3	57.4	126.7
1940	8.6	1.9	10.5	6.5	14.6	21.1	53.0	52.8	105.8
1941	7.5	1.7	9.2	18.8	39.5	58.3	60.4	78.1	138.5
1942	5.7	1.1	6.8	10.7	17.4	28.1	53.6	63.5	117.1
1943	3.7	0.7	4.4	6.8	10.0	16.8	30.2	43.5	73.7
1944	5.6	1.5	7.1	5.0	13.4	18.4	43.7	58.4	102.1
1945	10.7	2.8	13.5	13.3	28.8	42.1	66.6	89.6	156.2
1946	14.7	4.4	19.1	23.6	25.9	49.5	117.3	110.9	228.2
1947	18.5	5.6	24.1	33.9	35.4	69.3	148.4	156.8	305.2
1948	27.4	7.4	34.8	39.8	48.8	88.6	189.8	182.4	372.2
1949	23.5	8.5	32.0	14.8	53.1	67.9	170.7	198.2	368.9
1950	46.4	10.8	57.2	33.4	63.7	97.1	234.1	233.6	467.7
1951	44.6	14.7	59.3	34.0	61.5	95.5	207.4	240.1	447.5
1952	29.2	13.5	42.7	23.2	65.2	88.4	168.1	237.8	405.9
1953	48.6	13.1	61.7	22.3	83.6	105.9	263.1	295.7	558.8
1954	69.9	14.9	84.8	19.3	76.5	95.8	310.0	294.3	604.3
1955	63.8	15.5	79.3	25.1	83.1	108.2	299.9	304.1	604.0

Table 6B. 1 (Concluded)

8000 : Total Industry

	Construction	Machinery and equipment	Total
1926......	382.1	391.2	773.3
1927......	489.5	510.1	999.6
1928......	660.8	595.9	1,256.7
1929......	757.1	682.4	1,439.5
1930......	605.1	564.4	1,169.5
1931......	446.5	319.2	765.7
1932......	211.2	177.4	388.6
1933......	142.4	145.4	287.8
1934......	167.2	204.1	371.3
1935......	211.6	237.2	449.0
1936......	261.8	293.7	555.5
1937......	304.1	436.1	740.2
1938......	278.6	422.3	700.9
1939......	267.2	384.1	651.3
1940......	308.7	565.3	874.0
1941......	384.7	666.1	1,050.8
1942......	415.4	612.2	1,027.6
1943......	260.1	406.1	666.2
1944......	244.0	488.6	732.6
1945......	328.4	588.4	916.8
1946......	544.5	706.8	1,251.3
1947......	659.5	1,139.8	1,799.3
1948......	786.4	1,272.2	2,058.6
1949......	826.5	1,305.6	2,132.1
1950......	894.0	1,277.3	2,171.3
1951......	992.3	1,490.3	2,482.6
1952......	1,142.6	1,661.0	2,803.6
1953......	1,197.4	1,752.2	2,949.6
1954......	1,178.0	1,528.4	2,706.4
1955......	1,188.2	1,476.9	2,665.1

Table 6B. 2

GROSS STOCK OF CAPITAL BY INDUSTRY AND BY SECTOR, IN 1949 PRICES, 1926-55

1000 : Agriculture — Gross Stock

	Construction	Machinery and equipment	Total
1926......	—	993.4	—
1927......	—	1,028.7	—
1928......	—	1,177.8	—
1929......	—	1,290.3	—
1930......	—	1,312.4	—
1931......	—	1,252.0	—
1932......	—	1,200.1	—
1933......	—	1,115.2	—
1934......	—	1,081.7	—
1935......	1,055.5	1,097.7	2,153.2
1936......	1,055.3	1,109.3	2,164.6
1937......	1,057.5	1,165.7	2,223.2
1938......	1,058.8	1,220.5	2,279.3
1939......	1,063.9	1,206.6	2,270.5
1940......	1,071.5	1,187.0	2,258.5
1941......	1,065.1	1,128.5	2,193.6
1942......	1,051.2	1,064.7	2,115.9
1943......	1,036.4	1,000.3	2,036.7
1944......	1,032.0	1,054.0	2,086.0
1945......	1,038.0	1,139.1	2,177.1
1946......	1,047.1	1,288.7	2,335.8
1947......	1,058.8	1,505.3	2,564.1
1948......	1,076.6	1,755.1	2,831.7
1949......	1,076.4	2,033.0	3,109.4
1950......	1,075.3	2,302.6	3,377.9
1951......	1,099.6	2,551.0	3,650.6
1952......	1,123.4	2,817.6	3,941.0
1953......	1,151.2	3,048.0	4,199.2
1954......	1,186.0	3,154.5	4,340.5
1955......	1,237.2	3,316.0	4,553.2

Table 6B. 2 (Cont'd.)

2000 : Resource Industries — Gross Stock

	2080 : Forestry			2091 : Fishing	2100 : Mining, quarrying and oil wells		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1926	—	—	—	—	—	—	—
1927	—	—	—	—	—	—	—
1928	—	42.5	—	—	—	184.9	—
1929	—	44.8	—	—	—	197.6	—
1930	—	46.9	—	—	—	209.0	—
1931	—	46.4	—	65.8	—	209.7	—
1932	—	44.0	—	59.2	—	206.5	—
1933	—	41.1	—	55.1	—	204.7	—
1934	—	38.8	—	56.3	—	208.3	—
1935	—	36.5	—	51.3	—	212.9	—
1936	—	34.7	—	52.0	—	223.5	—
1937	—	33.1	—	54.6	—	240.1	—
1938	—	31.2	—	56.0	—	252.7	—
1939	—	30.1	—	53.6	—	286.4	—
1940	—	31.7	—	51.5	—	281.4	—
1941	—	38.2	—	51.7	—	292.2	—
1942	85.5	42.1	127.6	50.8	579.4	295.5	874.9
1943	85.8	43.7	129.5	52.4	569.5	289.2	858.7
1944	93.0	47.9	140 9	57.3	566.3	280.0	846.3
1945	96.6	52.6	149.2	67.0	566.6	255.3	821.9
1946	100.1	58.4	158.5	77.2	585.1	248 8	833.9
1947	113.3	75.6	188.9	89.6	604.1	283.7	887.8
1948	122.7	86.2	208.9	101.4	647.1	329.1	976.2
1949	133.4	91.0	224.4	95.0	697.3	377.0	1,074.3
1950	144.4	98.2	242.6	119.9	744.6	408.1	1,152.7
1951	159.0	122.4	281.4	128.2	819.7	457.9	1,277.6
1952	171.5	134.6	306.1	134.7	913.6	502.7	1,416.3
1953	184.7	139.6	324.3	132.1	1,004.1	554.1	1,558.2
1954	203.7	147.4	351.1	127.1	1,099.1	609.4	1,708.5
1955	229.0	158.0	387.0	125.8	1,200.6	651.0	1,851.6

Table 6B. 2 (Cont'd.)

2000 : Resource Industries — Gross Stock (Cont'd.)

	2602 : Central electric stations and gas works			Total resource industries		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	—	—	—	—	—	—
1927	—	—	—	—	—	—
1928	—	387.2	—	—	—	—
1929	—	421.3	—	—	—	—
1930	—	457.4	—	—	—	—
1931	—	480.8	—	—	802.7	—
1932	—	493.9	—	—	803.6	—
1933	—	497.1	—	—	798.0	—
1934	—	498.5	—	—	801.9	—
1935	—	501.1	—	—	801.8	—
1936	—	507.2	—	—	817.4	—
1937	—	524.3	—	—	852.1	—
1938	—	541.5	—	—	881.4	—
1939	—	554.2	—	—	906.3	—
1940	—	565.0	—	—	929.6	—
1941	—	581.6	—	—	963.7	—
1942	1,514.1	599.5	2,113.6	2,179.0	987.9	3,166.9
1943	1,546.6	598.1	2,144.7	2,201.9	983.4	3,185.3
1944	1,561.7	593.7	2,155.4	2,221.0	978.9	3,199.9
1945	1,597.9	591.2	2,189.1	2,261.1	966.1	3,227.2
1946	1,671.1	596.3	2,267.4	2,356.3	980.7	3,337.0
1947	1,763.9	629.1	2,393.0	2,481.3	1,078.0	3,559.3
1948	1,931.5	686.0	2,617.5	2,701.3	1,202.7	3,904.0
1949	2,157.9	763.1	2,921.0	2,988.6	1,326.1	4,314.7
1950	2,398.5	822.8	3,221.3	3,287.5	1,449.0	4,736.5
1951	2,656.9	887.8	3,544.7	3,635.6	1,596.3	5,231.9
1952	2,961.5	994.3	3,955.8	4,046.6	1,766.3	5,812.9
1953	3,217.7	1,102.4	4,320.1	4,406.5	1,928.2	6,334.7
1954	3,438.4	1,177.2	4,615.2	4,741.2	2,061.1	6,802.3
1955	3,653.0	1,241.8	4,894.8	5,082.6	2,176.6	7,259.2

Table 6B. 2 (Cont'd.)

3000 : Primary Manufacturing — Gross Stock

	3200 : Food and beverages	3281 : Wood products			3294 : Pulp and paper		
	Machinery and equipment	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	—	—	—	—	—	157.4	—
1927	—	—	—	—	—	192.0	—
1928	—	—	—	—	—	216.4	—
1929	—	—	—	—	—	228.2	—
1930	—	—	55.8	—	—	257.9	—
1931	—	—	56.4	—	—	257.3	—
1932	—	—	56.2	—	—	255.1	—
1933	—	—	56.6	—	—	251.4	—
1934	—	—	56.6	—	—	250.5	—
1935	—	—	58.1	—	352.8	248.1	600.9
1936	—	—	59.2	—	354.8	248.5	603.3
1937	—	—	62.2	—	360.3	250.4	610.7
1938	—	—	63.8	—	363.7	250.9	614.6
1939	—	—	62.5	—	369.1	249.8	618.9
1940	—	—	63.0	—	375.8	257.0	632.8
1941	—	—	67.7	—	387.1	253.9	641.0
1942	—	—	66.4	—	391.4	253.2	644.6
1943	—	—	63.6	—	392.9	250.4	643.3
1944	—	—	60.6	—	401.8	252.1	653.9
1945	104.8	193.0	56.3	249.3	408.1	260.3	668.4
1946	115.8	201.6	60.8	262.4	437.6	276.7	714.3
1947	132.7	209.9	75.3	285.2	467.3	294.5	761.8
1948	152.9	210.7	84.6	295.3	491.9	312.7	804.6
1949	173.7	211.4	96.2	307.6	514.0	332.7	846.7
1950	190.4	213.2	108.9	322.1	530.1	363.8	893.9
1951	209.8	216.4	124.4	340.8	559.0	389.2	948.2
1952	229.7	218.5	138.0	356.5	580.3	451.5	1,031.8
1953	247.7	221.8	150.9	372.7	593.6	503.6	1,097.2
1954	268.9	223.7	164.7	388.4	606.1	545.7	1,151.3
1955	281.4	225.7	176.3	402.0	624.0	606.5	1,230.5

Table 6B. 2 (Cont'd.)

3000 : Primary Manufacturing — Gross Stock (Cont'd.)

	3345 : Non-ferrous metals and electrical equipment	3361: Non-metallic mineral and petroleum and coal products	3380 : Chemical products
	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945....	75.9	22.9	36.0
1946....	80.8	24.1	36.3
1947....	81.7	26.1	43.0
1948....	86.1	28.5	54.9
1949....	89.9	32.4	65.6
1950....	96.1	34.3	71.8
1951....	112.1	41.0	83.0
1952....	138.0	49.7	131.2
1953....	166.2	53.6	194.4
1954....	190.0	60.4	201.8
1955....	205.7	70.5	215.5

3000 : Primary Manufacturing — Gross Stock (Cont'd.)

	Residual construction	Capital items charged to operating expenditure	Total primary manufacturing		
		Machinery and equipment	Construction	Machinery and equipment	Total
1945.......	547.5	297.6	1,148.6	853.8	2,002.4
1946.......	574.8	302.7	1,214.0	897.2	2,111.2
1947.......	597.5	320.6	1,274.7	973.9	2,248.6
1948.......	626.5	342.3	1,329.1	1,062.0	2,391.1
1949.......	651.7	362.2	1,377.1	1,152.8	2,529.9
1950.......	668.7	380.8	1,412.8	1,246.1	2,658.1
1951.......	700.8	403.5	1,476.2	1,363.0	2,839.2
1952.......	771.0	433.0	1,569.8	1,571.1	3,140.9
1953.......	816.3	459.2	1,631.7	1,775.6	3,407.3
1954.......	845.0	476.9	1,674.8	1.908.4	3,582.2
1955.......	878.8	500.7	1,728.5	2,056.6	3,785.1

4000 : Secondary Manufacturing Industries — Gross Stock

	4218 : Food and beverages	4230 : Tobacco, rubber and leather	4251 : Textiles	4270 : Clothing
	Machinery and equipment	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945............	84.9	69.1	162.5	28.2
1946............	98.1	76.4	182.0	33.5
1947............	126.6	90.0	207.5	44.2
1948............	155.6	99.2	226.7	54.3
1949............	176.9	107.7	239.0	64.0
1950............	198.1	114.5	250.6	71.3
1951............	212.2	122.5	270.0	77.9
1952............	266.7	132.2	274.5	86.3
1953............	248.1	145.9	287.7	93.3
1954............	266.5	155.7	299.6	98.4
1955............	282.4	166.9	303.7	101.3

Table 6B. 2 (Cont'd.)

4000 : Secondary Manufacturing Industries — Gross Stock (Cont'd.)

	4286 : Wood products		4292 : Pulp and paper		4301 : Printing publishing and allied industries	4311 : Iron and steel products
	Construction	Machinery and equipment	Construction	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945.......	125.6	19.6	71.8	45.9	101.7	282.9
1946.......	131.3	21.1	77.0	48.8	94.0	299.4
1947.......	136.6	26.0	82.3	52.0	95.9	338.0
1948.......	137.2	29.1	86.7	55.2	104.4	373.2
1949.......	137.7	32.9	90.6	58.7	114.9	405.1
1950.......	138.9	37.2	93.5	64.2	113.6	425.2
1951.......	140.9	42.3	98.6	68.7	114.6	456.6
1952.......	142.3	46.9	102.4	79.7	115.8	522.0
1953.......	144.4	51.2	104.7	88.9	123.6	577.0
1954.......	145.7	55.8	106.9	96.3	136.8	623.1
1955.......	147.0	59.7	110.0	107.0	147.8	654.2

Table 6B. 2 (Cont'd.)

4000 : Secondary Manufacturing Industries — Gross Stock

	4330 : Transportation equipment	4341 : Non-ferrous metals and electrical equipment	4362 : Non-metallic mineral and petroleum and coal products	4381 : Chemical products
	Machinery and equipment	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945.......	106.8	92.7	59.1	35.7
1946.......	113.7	97.7	65.6	42.8
1947.......	119.7	111.7	81.1	55.0
1948.......	123.0	128.3	101.2	67.7
1949.......	127.7	147.1	114,1	79.4
1950.......	138.4	153.6	137.0	87.0
1951.......	153.7	167.9	175.4	106.0
1952.......	165.4	187.5	214.6	128.9
1953.......	193.4	211.4	242.0	140.6
1954.......	219.8	230.4	263.4	152.2
1955.......	243.5	253.7	277.9	162.5

4000 : Secondary Manufacturing Industries — Gross Stock (Cont'd.)

	4391 : Miscellaneous manufacturing	Capital items charged to operating expenditure	Residual construction	Total secondary manufacturing		
	Machinery and equipment	Machinery and equipment		Construction	Machinery and equipment	Total
1945.......	22.6	774.8	2,328.1	2,525.5	1,886.5	4,412.0
1946.......	24.9	795.1	2,415.1	2,623.4	1,993.1	4,616.5
1947.......	28.4	823.4	2,550.6	2,769.5	2,199.5	4,969.0
1948.......	31.9	857.0	2,665.6	2,889.5	2,406.8	5,296.3
1949.......	34.8	889.2	2,754.6	2,982.9	2,591.5	5,574.4
1950.......	37.0	915.2	2,830.3	3,062.7	2,742.9	5,805.6
1951.......	39.6	943.6	2,966.5	3,206.0	2,951.0	6,157.0
1952.......	41.5	975.8	3,099.3	3,343.9	3,197.9	6,541.8
1953.......	44.2	1,003.0	3,231.8	3,480.9	3,440.3	6,921.2
1954.......	46.4	1,031.5	3,376.1	3,628.7	3,675.9	7,304.6
1955.......	49.6	1,058.4	3,533.8	3,790.8	3,868.6	7,659.4

Table 6B. 2 (Cont'd.)

5000 : Transport, Storage and Communication — Gross Stock

	5508 : Steam railways		5510 : Electric railways		5547 : Telephones and broadcasting	
	Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Machinery and equipment
1945.......	6,359.9	1,071.7	207.6	85.5	359.2	479.9
1946.......	6,374.3	1,058.2	209.1	82.4	387.0	496.2
1947.......	6,359.1	1,079.1	201.9	85.6	418.0	539.0
1948.......	6,317.1	1,134.2	193.8	94.1	453.3	586.4
1949.......	6,313.0	1,166.9	191.7	96.3	480.6	633.7
1950.......	6,279.9	1,208.9	195.2	103.4	512.1	676.5
1951.......	6,256.0	1,277.0	200.5	108.8	545.3	721.1
1952.......	6,258.8	1,375.0	211.9	109.5	581.9	780.5
1953.......	6,243.5	1,515.5	220.1	115.2	622.2	842.8
1954.......	6,175.8	1,645.6	225.1	114.5	667.0	919.9
1955.......	6,073.3	1,679.0	228.9	119.1	708.8	987.6

5000 : Transport, Storage and Communication — Gross Stock (Cont'd.)

	All other transport, storage and communication including capital items charged to operating expenditure		Residual construction	Total transport, storage and communication — gross stock		
	Construction	Machinery and equipment		Construction	Machinery and equipment	Total
1945.......	—	507.3	223.0	7,149.7	2,144.4	9,294.1
1946.......	—	549.5	230.6	7,201.0	2,186.3	9,387.3
1947.......	.7	601.8	244.8	7,224.5	2,305.5	9,530.0
1948.......	1.1	641.7	259.1	7,224.4	2,456.4	9,680.8
1949.......	7.7	695.9	273.7	7,266.7	2,592.8	9,859.5
1950.......	57.6	740.0	281.4	7,326.2	2,728.8	10,055.0
1951.......	65.3	722.8	291.8	7,358.9	2,829.7	10,188.6
1952.......	124.3	674.7	301.3	7,478.2	2,939.7	10,417.9
1953.......	177.9	708.3	319.2	7,582.9	3,181.8	10,764.7
1954.......	224.8	727.5	339.2	7,631.9	3,407.5	11,039.4
1955.......	256.0	720.8	358.8	7,625.8	3,506.5	11,132.3

Table 6B. 2 (Cont'd.)

6000 : Trades, Services and Construction — Gross Stock

	6404 : Construction industry			6608 : Waterworks	6731 : Wholesale and retail trade		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1941	—	—	—	—	—	221.3	—
1942	—	—	—	—	—	226.6	—
1943	—	—	—	—	—	219.2	—
1944	—	—	—	—	—	215.6	—
1945	81.4	190.2	271.6	216.8	1,214.3	206.1	1,420.4
1946	84.7	209.6	294.3	227.2	1,272.1	227.9	1,500.0
1947	86.1	253.3	339.4	238.1	1,348.6	274.0	1,622.6
1948	91.5	291.5	383.0	251.4	1,444.3	336.8	1,781.1
1949	100.4	318.6	419.0	267.7	1,542.9	423.4	1,966.3
1950	110.4	351.4	461.8	291.6	1,654.9	519.2	2,174.1
1951	113.0	373.8	486.8	320.2	1,741.9	622.7	2,364.6
1952	113.4	409.9	523.3	354.5	1,802.1	708.2	2,510.3
1953	115.3	459.3	574.6	389.9	1,928.6	819.3	2,747.9
1954	115.0	500.6	615.6	432.7	2,079.5	925.0	3,004.5
1955	116.6	541.9	658.5	467.6	2,229.4	1,033.7	3,263.1

6000 : Trades, Services and Construction — Gross Stock (Cont'd.)

	6800 : Finance, insurance and real estate			6920 : Commercial services		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1945	471.7	21.7	493.4	488.8	229.5	718.3
1946	484.7	23.9	508.6	511.2	249.8	761.0
1947	501.5	28.0	529.5	543.9	276.3	820.2
1948	527.2	34.3	561.5	582.5	314.7	897.2
1949	549.0	41.8	590.8	596.1	345.8	941.9
1950	593.7	51.6	645.3	628.2	390.8	1,019.0
1951	635.8	65.1	700.9	660.5	436.2	1,096.7
1952	658.5	77.1	735.6	679.0	477.3	1,156.3
1953	698.6	88.6	787.2	695.2	546.3	1,241.5
1954	761.1	102.6	863.7	709.2	583.3	1,292.5
1955	818.7	116.2	934.9	729.9	649.0	1,378.9

Table 6B. 2 (Cont'd.)

6000 : Trades, Services and Construction — Gross Stock (Cont'd.)

	Total trades, services and construction including capital items charged to operating expenses		
	Construction	Machinery and equipment	Total
1945	2,473.0	674.2	3,147.2
1946	2,579.9	738.0	3,317.9
1947	2,718.2	859.7	3,577.9
1948	2,896.9	1,007.5	3,904.4
1949	3,056.1	1,162.1	4,218.2
1950	3,278.8	1,346.4	4,625.2
1951	3,471.4	1,533.5	5,004.9
1952	3,607.5	1,710.9	5,318.4
1953	3,827.6	1,954.5	5,782.1
1954	4,097.5	2,154.6	6,252.1
1955	4,362.2	2,385.8	6,748.0

8000 : Total Industry — Gross Stock

	Construction	Machinery and equipment	Total
1945	16,595.9	7,664.1	24,260.0
1946	17,021.7	8,084.0	25,105.7
1947	17,527.0	8,921.9	26,448.9
1948	18,117.8	9,890.5	28,008.3
1949	18,747.8	10,858.3	29,606.1
1950	19,442.5	11,815.8	31,258.3
1951	20,247.7	12,824.5	33,072.2
1952	21,169.4	14,003.5	35,172.9
1953	22,080.8	15,328.4	37,409.2
1954	22,960.1	16,362.0	39,322.1
1955	23,827.1	17,310.1	41,137.2

Table 6B. 3

NET STOCK OF CAPITAL BY INDUSTRY AND BY SECTOR, IN 1949 PRICES, 1926-55

1000 : Agriculture — Net Stock

	Construction	Machinery and equipment	Total
1926	—	521.2	—
1927	—	588.4	—
1928	—	696.1	—
1929	—	768.1	—
1930	—	786.6	—
1931	—	730.1	—
1932	—	672.9	—
1933	—	607.4	—
1934	—	573.3	—
1935	498.0	547.5	1,045.5
1936	487.2	535.6	1,022.8
1937	479.1	552.9	1,032.0
1938	470.1	566.7	1,036.8
1939	464.1	570.5	1,034.6
1940	459.0	601.7	1,060.7
1941	457.5	638.7	1,096.2
1942	454.1	650.7	1,104.8
1943	451.0	622.2	1,073.2
1944	455.8	643.3	1,099.1
1945	466.0	686.5	1,152.5
1946	487.9	775.3	1,263.2
1947	510.0	944.5	1,454.5
1948	536.2	1,135.9	1,672.1
1949	560.5	1,351.3	1,911.8
1950	588.6	1,567.1	2,155.7
1951	619.7	1,741.9	2,361.6
1952	655.9	1,910.0	2,565.9
1953	692.7	2,047.6	2,740.3
1954	723.6	2,048.0	2,771.6
1955	754.1	2,065.6	2,819.7

Table 6B. 3 (Cont'd.)

2000 : Resource Industries — Net Stock

	2080 : Forestry			2091 : Fishing	2100 : Mining, quarrying and oil wells		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1926	—	—	—	—	—	—	—
1927	—	—	—	—	—	—	—
1928	—	25.8	—	—	—	102.3	—
1929	—	26.8	—	—	—	123.5	—
1930	—	27.3	—	—	—	135.7	—
1931	—	25.6	—	34.6	—	134.1	—
1932	—	22.6	—	30.4	—	128.3	—
1933	—	20.0	—	30.2	—	121.5	—
1934	—	18.3	—	31.4	—	120.0	—
1935	—	17.0	—	31.1	—	118.9	—
1936	—	16.7	—	32.9	—	122.7	—
1937	—	17.1	—	32.5	—	133.5	—
1938	—	17.3	—	31.6	—	141.9	—
1939	—	18.2	—	29.6	—	149.8	—
1940	—	20.0	—	29.0	—	156.9	—
1941	—	25.1	—	29.6	—	163.5	—
1942	42.3	27.1	69.4	30.5	325.6	161.9	487.5
1943	42.4	26.9	69.3	31.9	313.5	153.5	467.0
1944	50.1	29.2	79.3	36.3	302.7	146.3	449.0
1945	54.4	32.3	86.7	43.7	293.7	136.8	430.5
1946	58.3	36.6	94.9	51.1	303.6	138.9	442.5
1947	71.9	51.2	123.1	59.8	316.3	169.7	486.0
1948	81.2	57.7	138.9	66.2	348.5	204.7	553.2
1949	91.3	58.1	149.4	67.3	390.6	238.2	622.8
1950	101.3	63.8	165.1	74.9	431.1	257.0	628.1
1951	113.9	83.3	197.2	80.2	491.0	293.2	784.2
1952	122.1	86.4	208.5	83.9	566.6	326.5	893.1
1953	129.2	83.6	212.8	80.4	654.1	371.2	1,025.3
1954	141.7	84.3	226.0	74.7	750.7	415.4	1,166.1
1955	160.0	88.6	248.6	70.2	860.7	442.5	1,303.2

Table 6B. 3 (Cont'd.)

2000 : Resource Industries — Net Stock (Cont'd.)

	2602 : Central electric stations and gas works			Total resource industries		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926.......	—	—	—	—	—	—
1927.......	—	—	—	—	—	—
1928.......	—	267.2	—	—	—	—
1929.......	—	290.1	—	—	—	—
1930.......	—	314.6	—	—	—	—
1931.......	—	325.8	—	—	520.1	—
1932.......	—	327.2	—	—	508.5	—
1933.......	—	319.1	—	—	490.8	—
1934.......	—	311.6	—	—	481.3	—
1935.......	—	307.0	—	—	474.0	—
1936.......	—	303.2	—	—	475.5	—
1937.......	—	308.2	—	—	491.3	—
1938.......	—	312.2	—	—	503.0	—
1939.......	—	311.9	—	—	509.5	—
1940.......	—	310.4	—	—	516.3	—
1941.......	—	317.7	—	—	535.9	—
1942.......	1,065.3	329.7	1,395.0	1,433.2	549.2	1,982.4
1943.......	1,070.9	324.6	1,395.5	1,426.8	536.9	1,963.7
1944.......	1,058.6	314.4	1,373.0	1,411.4	526.2	1,937.6
1945.......	1,067.2	300.7	1,367.9	1,415.3	513.5	1,928.8
1946.......	1,112.3	295.0	1,407.3	1,474.2	521.6	1.995,8
1947.......	1,175.9	319.3	1,495.2	1,564.1	600.0	2,164.1
1948.......	1,312.8	369.6	1,682.4	1,742.5	698.2	2,440.7
1949.......	1,505.8	438.5	1,944.3	1,987.7	802.1	2,789.8
1950.......	1,709.3	489.7	2,199.0	2,241.7	885.4	3,127.1
1951.......	1,926.9	555.3	2,482.2	2,531.8	1,012.0	3,543.8
1952.......	2,186.9	648.8	2,835.7	2,875.6	1,145.6	4,021.2
1953.......	2,392.5	744.2	3,136.7	3,175.8	1,279.4	4,455.2
1954.......	2,558.4	810.7	3,369.1	3,450.8	1,385.1	4,835.9
1955.......	2,715.6	855.3	3,570.9	3,736.3	1,456.6	5,192.9

Table 6B. 3 (Cont'd.)

3000 : Primary Manufacturing — Net Stock

	3200 : Food and beverages	3281 : Wood products			3294 : Pulp and paper		
	Machinery and equipment	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	—	—	—	—	—	110.1	—
1927	—	—	—	—	—	138.7	—
1928	—	—	—	—	—	156.0	—
1929	—	—	—	—	—	160.1	—
1930	—	—	36.9	—	—	182.1	—
1931	—	—	36.6	—	—	173.0	—
1932	—	—	35.4	—	—	162.8	—
1933	—	—	34.1	—	—	151.8	—
1934	—	—	32.5	—	—	144 4	—
1935	—	—	32.1	—	261.6	136.5	398.1
1936	—	—	30.8	—	256.8	130.6	387.4
1937	—	—	31.6	—	255.5	128.0	383.5
1938	—	—	31.2	—	252.0	123.0	375.0
1939	—	—	29.6	—	250.4	114.4	364.8
1940	—	—	29.2	—	250.1	116.2	366.3
1941	—	—	31.5	—	254.3	111.5	365.8
1942	—	—	31.4	—	251.3	111.6	362.9
1943	—	—	30.9	—	245.5	105.9	351.4
1944	—	—	29.5	—	247.0	102.1	349.1
1945	56.5	115.1	29.4	144.5	245.9	103.3	349.2
1946	69.1	118.3	35.3	153.6	267.8	123.3	391.1
1947	89.3	120.8	49.8	170.6	289.4	160.8	450.2
1948	110.1	119.8	60.3	180.1	305.4	201.1	506.5
1949	126.7	118.3	70.0	188.3	318.4	232.7	551.1
1950	136.1	116.9	79.3	196.2	324.9	262.4	587.3
1951	146.4	116.6	90.7	207.3	343.9	303.4	647.3
1952	157.3	114.9	98.8	213.7	354.8	350.3	705.1
1953	166.6	113.5	106.8	220.3	357.4	382.9	740.3
1954	178.2	111.1	114.1	225.2	359.2	402.2	761.4
1955	183.0	109.3	120.7	230.0	6.6	441.6	808.2

Table 6B. 3 (Cont'd.)

3000 : Primary Manufacturing — Net Stock (Cont'd.)

	3345 : Non-ferrous metals and electrical equipment	3361 : Non-metallic mineral and petroleum and coal products	3380 : Chemical products
	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945....	45.0	12.7	21.0
1946....	48.7	13.8	20.8
1947....	48.7	16.0	25.9
1948....	54.7	19.0	37.5
1949....	57.3	22.4	46.0
1950....	60.9	23.9	49.6
1951....	72.4	30.2	58.1
1952....	93.1	38.4	102.6
1953....	115.0	41.3	160.0
1954....	131.9	47.1	156.5
1955....	143.4	55.2	160.2

3000 : Primary Manufacturing — Net Stock (Cont'd.)

	Residual construction	Capital items charged to operating expenditure	Total primary manufacturing		
		Machinery and equipment	Construction	Machinery and equipment	Total
1945..	354.6	219.5	715.6	487.4	1,203.0
1946..	372.6	220.2	758.7	531.2	1,289.9
1947..	385.4	223.8	795.6	614.3	1,409.9
1948..	404.0	228.3	829.2	711.0	1,5 40.2
1949..	418.3	228.6	855.0	783.7	1,638.7
1950..	423.9	227.0	865.7	893.2	1,758.9
1951..	444.9	229.9	905.4	931.1	1,836.5
1952..	507.1	238.7	976.8	1,079.2	2,056.0
1953..	544.8	245.9	1,015.7	1,218.5	2,234.2
1954..	563.8	242.5	1,034.1	1,272.5	2,306.6
1955..	586.4	242.4	1,062.3	1,346.5	2,408.8

4000 : Secondary Manufacturing Industries — Net Stock

	4218 : Food and beverages	4230 : Tobacco, rubber and leather	4251 : Textiles	4270 : Clothing
	Machinery and equipment	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945....	52.1	26.1	84.6	17.3
1946....	61.8	29.1	96.4	22.5
1947....	85.0	37.9	117.0	32.1
1948....	108.0	41.5	138.1	40.3
1949....	122.8	43.8	152.4	47.6
1950....	135.9	43.9	159.9	52.2
1951....	144.1	44.7	172.7	55.4
1952....	152.5	46.8	182.1	60.6
1953....	166.0	52.1	186.6	64.6
1954....	174.7	56.4	190.6	65.4
1955....	179.5	60.7	188.0	64.8

Table 6B. 3 (Cont'd.)

4000 : Secondary Manufacturing Industries — Net Stock (Cont'd.)

	4286 : Wood products		4292 : Pulp and paper		4301 : Printing, publishing and allied industries	4311 : Iron and steel products
	Construction	Machinery and equipment	Construction	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945.......	75.0	9.5	43.3	18.2	40.8	203.5
1946.......	77.0	11.4	47.2	21.8	40.1	212.1
1947.......	78.6	16.2	51.1	28.4	44.2	239.1
1948.......	78.0	19.7	54.0	35.5	51.8	259.8
1949.......	77.0	22.9	56.3	41.1	59.4	276.3
1950.......	76.1	25.9	57.5	46.3	65.8	283.5
1951.......	75.9	29.7	60.8	53.5	74.3	303.1
1952.......	74.8	32.3	62.7	61.8	77.5	355.7
1953.......	73.9	25.0	63.2	67.6	81.2	392.8
1954.......	72.3	37.6	63.5	71.0	91.1	414.1
1955.......	71.1	39.6	64.8	77.9	98.8	422.9

Table 6B. 3 (Cont'd.)

4000 : Secondary Manufacturing Industries — Net Stock (Cont'd.)

	4330 : Transportation equipment	4341 : Non-ferrous metals and electrical equipment	4362 : Non-metallic mineral and petroleum and coal products	4381 : Chemical products
	Machinery and equipment	Machinery and equipment	Machinery and equipment	Machinery and equipment
1945....	68.6	54.6	29.1	18.9
1946....	71.2	58.9	36.6	25.0
1947....	71.4	71.3	52.7	37.3
1948....	72.1	85.8	74.4	48.9
1949....	75.2	102.3	86.7	60.4
1950....	81.7	108.2	105.8	66.3
1951....	94.6	119.0	138.4	82.3
1952....	103.5	132.9	170.1	100.5
1953....	134.7	148.3	187.6	107.6
1954....	158.7	158.0	197.4	113.2
1955....	170.9	171.3	199.6	117.2

4000 : Secondary Manufacturing Industries — Net Stock (Cont'd.)

	4391 : Miscellaneous manufacturing	Capital items charged to operating expenditure	Residual construction	Total secondary manufacturing		
	Machinery and equipment	Machinery and equipment		Construction	Machinery and equipment	Total
1945.......	14.2	585.9	1,417.4	1,535.7	1,223.4	2,759.1
1946.......	16.3	573.5	1,464.8	1,589.0	1,276.7	2,865.7
1947.......	18.7	566.9	1,558.4	1,688.1	1,418.2	3,106.3
1948.......	20.8	556.3	1,630.0	1,762.0	1,553.0	3,315.0
1949.......	22.2	541.9	1,672.7	1,806.0	1,655.0	3,461.0
1950.......	23.2	521.0	1,700.3	1,833.9	1,719.6	3,553.5
1951.......	24.5	504.5	1,790.1	1,880.6	1,840.8	3,721.4
1952.......	25.3	489.5	1,890.5	2,028.0	1,821.0	3,849.0
1953.......	26.8	472.7	1,996.0	2,133.1	2,113.6	4,246.7
1954.......	27.6	454.4	2,105.9	2,241.7	2,210.2	4,451.9
1955.......	29.8	432.6	2,221.6	2,357.5	2,253.6	4,611.1

Table 6B. 3 (Cont'd.)

5000 : Transport, Storage and Communication — Net Stock

	5508 : Steam railways		5510 : Electric railways		5547 : Telephones and broadcasting	
	Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Machinery and equipment
1945.......	2,643.2	534.8	125.6	42.2	159.6	251.2
1946.......	2,560.3	524.2	123.5	44.8	182.2	255.5
1947.......	2,465.2	550.6	125.3	59.3	212.0	286.1
1948.......	2,378.4	608.1	127.1	67.6	246.4	325.1
1949.......	2,306.0	648.9	128.0	76.0	283.0	366.3
1950.......	2,214.9	667.3	134.0	81.0	310.1	402.8
1951.......	2,141.2	750.0	143.3	82.0	338.1	438.4
1952.......	2,092.8	841.5	153.2	81.3	366.7	489.1
1953.......	2,053.4	945.2	158.2	88.4	402.8	543.9
1954.......	1,986.2	1,056.4	159.2	88.5	442.2	618.1
1955.......	1,916.4	1,091.9	158.7	91.1	480.2	690.3

5000 : Transport, Storage and Communication — Net Stock (Cont'd.)

	All other transport, storage and communication including capital items charged to operating expenditure		Residual construction	Total transport, storage and communication		
	Construction	Machinery and equipment		Construction	Machinery and equipment	Total
1945.......	—	181.9	137.8	3,066.2	1,010.1	4,076.3
1946.......	—	196.6	142.7	3,008.7	1,021.1	4,029.8
1947.......	.7	219.6	154.0	2,957.2	1,115.6	4,072.8
1948.......	1.1	218.1	165.1	2,918.1	1,218.9	4,137.0
1949.......	7.7	226.6	176.3	2,901.0	1,317.8	4,218.8
1950.......	57.4	234.2	180.5	2,896.9	1,385.3	4,282.2
1951.......	63.6	238.9	187.3	2,873.5	1,509.3	4,382.8
1952.......	121.0	259.1	193.1	2,926.8	1,671.0	4,597.8
1953.......	171.5	286.1	207.2	2,993.1	1,863.6	4,856.7
1954.......	214.0	302.1	221.8	3,023.4	2,065.1	5,088.5
1955.......	239.5	332.2	238.1	3,032.9	2,205.5	5,238.4

6000 : *Trades, Services and Construction — Net Stock*

Table 6B. 3 (Cont'd.)

	6404 : Construction industry			6608 : Waterworks	6700 : Wholesale and retail trade		
	Construction	Machinery and equipment	Total	Total	Construction	Machinery and equipment	Total
1941	—	—	—	—	—	115.0	—
1942	—	—	—	—	—	116.8	—
1943	—	—	—	—	—	108.4	—
1944	—	—	—	—	—	114.5	—
1945	43.5	118.0	161.5	130.0	694.9	122.8	817.7
1946	46.2	134.3	180.5	136.7	732.7	150.8	883.5
1947	46.4	168.7	215.1	143.8	787.9	191.8	979.7
1948	51.3	195.0	246.3	153.4	860.8	243.3	1,104.1
1949	59.6	205.6	265.2	166.0	934.8	312.5	1,247.3
1950	68.8	222.5	291.3	185.6	1,020.1	389.8	1,409.9
1951	70.3	233.5	303.8	209.5	1,080.1	467.8	1,547.9
1952	69.7	252.7	322.4	238.7	1,121.5	523.3	1,644.8
1953	72.8	277.0	349.8	268.8	1,232.8	603.9	1,836.7
1954	75.0	301.2	376.2	306.1	1,363.1	676.6	2,039.7
1955	78.4	324.3	402.7	335.3	1,486.6	742.2	2,228.8

6000 : *Trades, Services and Construction — Net Stock (Cont'd.)*

	6800 : Finance, insurance and real estate			6920 : Commercial services		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1945	259.7	11.9	271.6	301.7	137.9	439.6
1946	265.0	14.9	279.9	315.5	146.2	461.7
1947	273.8	18.9	292.7	339.2	162.3	501.5
1948	291.2	24.4	315.6	368.1	189.9	558.0
1949	304.1	30.6	334.7	371.2	218.8	590.0
1950	339.5	38.7	378.2	392.7	255.9	648.6
1951	372.3	49.9	422.2	414.1	287.3	701.4
1952	388.7	59.1	447.8	424.1	319.0	743.1
1953	424.2	67.0	491.2	432.8	365.9	798.7
1954	480.1	76.0	556.1	438.2	400.4	838.6
1955	528.7	84.7	613.4	449.1	438.6	887.7

Table 6B. 3 (Cont'd.)

6000 : Trades, Services and Construction — Net Stock (Cont'd.)

	Total trades, services and construction including capital items charged to operating expenses.		
	Construction	Machinery and equipment	Total
1945	1,429.8	406.3	1,836.1
1946	1,496.1	462.5	1,958.6
1947	1,591.1	559.3	2,150.4
1948	1,724.8	671.6	2,396.4
1949	1,835.7	787.9	2,623.6
1950	2,006.7	928.2	2,934.9
1951	2,146.3	1,061.2	3,207.5
1952	2,242.7	1,178.5	3,421.2
1953	2,431.4	1,340.1	3,771.5
1954	2,662.5	1,481.7	4,144.2
1955	2,878.1	1,618.0	4,496.1

8000 : Total Industry — Net Stock

	Construction	Machinery and equipment	Total
1945	8,628.6	4,327.2	12,955.8
1946	8,814.6	4,588.4	13,403.0
1947	9,106.1	5,251.9	14,358.0
1948	9,512.9	5,988.6	15,501.5
1949	9,945.9	6,697.8	16,643.7
1950	10,433.5	7,378.8	17,812.3
1951	10,957.3	8,096.3	19,053.6
1952	11,705.8	8,805.3	20,511.1
1953	12,441.8	9,862.8	22,304.6
1954	13,136.1	10,462.6	23,598.7
1955	13,821.1	10,945.8	24,766.9

Table 6B. 4

INVESTMENT IN SOCIAL CAPITAL BY SECTOR AND BY TYPE OF ASSET IN 1949 PRICES, 1926-55

7000 : Social Capital — Investment Government

	7001 : Road construction	7002 : Building construction	7003 : "Other engineering" construction	Total construction	7004 : Machinery and equipment	Total goverment
1926.......	57.9	13.0	54.4	125.3	19.0	144.3
1927.......	74.8	31.0	75.5	181.3	24.7	206.0
1928.......	86.0	22.2	79.8	188.0	28.1	216.1
1929.......	101.9	26.9	82.9	211.7	32.4	244.1
1930.......	132.7	41.8	108.8	283.3	40.5	323.8
1931.......	126.8	32.7	96.3	255.8	33.4	289.2
1932.......	96.7	20.6	62.7	180.0	24.6	204.6
1933.......	68.9	14.6	48.6	132.1	19.6	151.7
1934.......	105.0	16.8	51.9	173.7	23.3	197.0
1935.......	114.3	18.8	56.8	189.9	28.2	218.1
1936.......	109.5	16.7	42.0	168.2	29.6	197.8
1937.......	175.2	18.9	43.7	237.8	36.0	273.8
1938.......	168.5	22.8	26.8	218.1	37.5	255.6
1939.......	145.7	30.9	29.5	206.1	39.2	245.3
1940.......	131.5	166.7	7.9	306.1	97.4	403.5
1941.......	86.3	302.1	92.1	480.5	205.4	685.9
1942.......	52.0	365.6	94.0	511.6	190.9	702.5
1943.......	45.5	302.8	95.8	444.1	191.1	635.2
1944.......	66.8	145.4	33.4	245.6	89.0	334.6
1945.......	79.2	77.0	48.2	204.4	78.8	283.2
1946.......	152.1	31.6	54.6	238.3	55.0	293.3
1947.......	188.0	46.1	57.5	291.6	52.3	343.9
1948.......	214.4	64.6	69.1	348.1	64.6	412.7
1949.......	220.6	75.9	63.5	360.0	46.0	406.0
1950.......	213.6	90.4	75.1	379.1	45.6	424.7
1951.......	228.8	148.3	84.2	461.3	50.8	512.1
1952.......	266.8	214.9	115.6	597.3	74.9	672.2
1953.......	234.2	186.8	151.4	572.4	72.5	644.9
1954.......	245.6	165.6	132.3	543.5	63.0	606.5
1955.......	257.0	184.7	169.4	611.1	54.3	665.4

Table 6B. 4 (Cont'd.)

7000 : Social Capital — Investment (Cont'd.)

	7809 : Housing construction	7900 : Institutions[a]			7000 : Total social capital		
		Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	441.5	54.9	6.7	61.6	621.7	25.7	647.4
1927	450.3	65.4	8.6	74.0	697.0	33.3	730.3
1928	478.1	67.2	9.1	76.3	733.3	37.2	770.5
1929	479.1	74.5	10.4	84.9	765.3	42.8	808.1
1930	406.4	88.9	12.8	101.7	778.6	53.3	831.9
1931	358.3	76.2	11.2	87.4	690.3	44.6	734.9
1932	222.8	50.4	6.9	57.3	453.2	31.5	484.7
1933	189.1	24.1	3.0	27.1	345.3	22.6	367.9
1934	230.4	20.3	2.9	23.2	424.4	26.2	450.6
1935	269.4	22.3	3.0	25.3	481.6	31.2	512.8
1936	320.3	29.9	3.8	33.7	518.4	33.4	551.8
1937	376.2	33.6	4.6	38.2	647.6	40.6	688.2
1938	343 0	41.1	5.7	46.8	607.2	43.2	650.4
1939	402.8	46.1	6.0	52.1	655.0	45.2	700.2
1940	408.0	26.8	3.7	30.5	740.9	101.1	842.0
1941	448.0	23.5	3.1	26.6	952.0	208.5	1,160.5
1942	378.8	20.7	2.7	23.4	911.1	193.6	1,104.7
1943	319.6	23.6	3.4	27.0	787.3	194.5	981.8
1944	352.4	34.0	4.8	38.8	632.0	93.8	725.8
1945	414.9	55.5	8.0	63.5	674.8	86.8	761.6
1946	559.4	84.8	12.9	97.7	882.5	67.9	950.4
1947	657.7	90.8	14.8	105.6	1,040.1	67.1	1,107.2
1948	710.1	129.8	22.6	152.4	1,188.0	87.2	1,275.2
1949	776.0	167.5	22.4	189.9	1,303.5	68.4	1,371.9
1950	802.0	174.1	24.0	198.1	1,355.2	69.6	1,424.8
1951	683.0	175.7	25.3	201.0	1,320.0	76.1	1,396.1
1952	667.2	195.9	28.0	223.9	1,460.4	102.9	1,563.3
1953	850.2	202.8	27.4	230.2	1,625.4	99.9	1,725.3
1954	918.9	223.4	33.6	257.0	1,685.8	96.6	1,782.4
1955	1,130.0	274.3	31.0	305.3	2,015.4	85.3	2,100.7

a Includes schools, universities, churches and hospitals.

Table 6B. 5

GROSS STOCK OF SOCIAL CAPITAL BY SECTOR AND BY TYPE OF ASSET, IN 1949 PRICES, 1926-55

7000 : Social Capital — Gross Stock
Government

	7001 : Roads	7002 : Buildings	7003 : "Other engineering" structures	Total construction	7004 : Machinery and equipment	Total
1926.......	885.0	—	—	—	258.1	—
1927.......	946.1	—	—	—	255.8	—
1928.......	1,018.4	—	—	—	252.2	—
1929.......	1,103.3	—	—	—	253.0	—
1930.......	1,214.9	—	—	—	270.8	—
1931.......	1,319.7	—	—	—	292.7	—
1932.......	1,390.6	—	—	—	311.1	—
1933.......	1,428,9	—	—	—	324.4	—
1934.......	1,497.6	—	—	—	338.3	—
1935.......	1,564,8	—	2,746.2	—	356.7	—
1936.......	1,627.9	—	2,770.1	—	372.4	—
1937.......	1,753.5	—	2,798.0	—	392.0	—
1938.......	1,884.3	—	2,807.1	—	412.4	—
1939.......	2,002.3	—	2,816.4	—	434.6	—
1940.......	2,104.8	—	2,799.6	—	513.5	—
1941.......	2,161.8	—	2,856.7	—	699.9	—
1942.......	2,177.8	—	2,917.0	—	866.1	—
1943.......	2,175.6	—	2,978.2	—	1,029.1	—
1944.......	2,188.2	—	2,965.9	—	1,085.7	—
1945.......	2,203,9	2,172.2	2,963.4	7,339.5	1,124.0	8,463.5
1946.......	2,289.3	2,199.5	2,971.6	7,460.4	1,145.6	8,606.0
1947.......	2,424.4	2,241.8	2,932.0	7,598.2	1,173.3	8,771.5
1948.......	2,579.7	2,302.2	2,879.5	7,761.4	1,218.3	8,979.7
1949.......	2,742.4	2,373.3	2,841.9	7,957.6	1,241.0	9,198.6
1950.......	2,881.2	2,457.8	2,802.6	8,141.6	1,258.4	9,400.0
1951.......	3,024.0	2,597.7	2,747.9	8,369.6	1,279.6	9,649.2
1952.......	3,188.9	2,804.5	2,727.2	8.720,6	1,318.5	10,039.1
1953.......	3,290.4	2,983.0	2,716.1	8,989.5	1,353.5	10,343.0
1954.......	3,409.2	2,137.7	2,688.6	9,235.5	1,377.3	10,612.8
1955.......	3,569.5	3,310.3	2,728.4	9,608.2	1,334.2	10,942.4

Table 6B. 5 (Cont'd.)

7000 : Social Capital — Gross Stock (Cont'd.)

	7809 : Housing construction	7900 : Institutions[a]			7000 : Total social capital		
		Construction	Machinery and equipment	Total	Construction	Machinery and 5quipment	Total
1926	—	—	99.2	—	—	357.3	—
1927	—	—	98.8	—	—	354.6	—
1928	—	—	97.7	—	—	349.9	—
1929	—	—	97.0	—	—	350.0	—
1930	—	—	101.5	—	—	372.3	—
1931	—	—	107.3	—	—	400.0	—
1932	—	—	110.9	—	—	422.0	—
1933	—	—	110.8	—	—	435.2	—
1934	—	—	110.0	—	—	448.3	—
1935	—	—	108.4	—	—	465.1	—
1936	—	—	106.2	—	—	478.6	—
1937	—	—	106.0	—	—	498.0	—
1938	—	—	105.8	—	—	518.2	—
1939	—	—	105.9	—	—	540.5	—
1940	—	—	103.5	—	—	617.0	—
1941	—	—	100.1	—	—	800.0	—
1942	—	—	96.1	—	—	962.2	—
1943	—	—	90.9	—	—	1,120.0	—
1944	—	—	86.6	—	—	1,172.3	—
1945	15,564.6	2,338.2	84.2	2,422.4	25,242.3	1,208.2	26,450.5
1946	16,016.7	2,407.7	84.3	2,492.0	25,884.8	1,229.9	27,114.7
1947	16,580.2	2,485.6	87.9	2,573.5	26,664.0	1,261.2	28,925.2
1948	17,185.1	2,600.7	103.6	2,704.3	27,547.2	1,321.9	28,869.1
1949	17,843.4	2,751.9	123.0	2,874.9	28,552.9	1,364.0	29,916.9
1950	18,501.1	2,905.0	144.1	3,049.1	29,547.7	1,402.5	30,950.2
1951	19,044.8	3,056.9	166.4	3,223.3	30,471.3	1,446.0	31,917.3
1952	19,543.8	3,223.6	190.6	3,414.2	31,488.0	1,509.1	32,997.1
1953	20,184.9	3,391.3	213.4	3,604.7	32,565.7	1,566.9	34,132.6
1954	20,871.8	3,575.3	241.3	3,816.6	33,682.6	1,618.6	35,301.2
1955	21,742.1	3,804.4	266.3	4,070.7	35,161.5	1,600.5	36,762.0

a Includes schools, universities, churches and hospitals.

NET STOCK OF SOCIAL CAPITAL BY SECTOR AND BY TYPE OF ASSET, IN 1949 PRICES, 1926-55

Table 6B. 6

7000 : Social Capital — Net Stock
Government

	7001 : Roads	7002 : Buildings	7003 : "Other engineering" structures	Total construction	7004 : Machinery and equipment	Total government
1926.......	551.4	—	—	—	124.4	—
1927.......	587.7	—	—	—	131.9	—
1928.......	632.6	—	—	—	142.9	—
1929.......	690.2	—	—	—	158.5	—
1930.......	774.9	—	—	—	182.1	—
1931.......	848.9	—	—	—	197.4	—
1932.......	888.2	—	—	—	202.5	—
1933.......	896.6	—	—	—	201.4	—
1934.......	939.5	—	—	—	203.1	—
1935.......	988.7	—	1,502.2	—	208.7	—
1936.......	1,030.2	—	1,475.5	—	214.5	—
1937.......	1,134.6	—	1,449.9	—	225.7	—
1938.......	1,226.9	—	1,406.7	—	237.1	—
1939.......	1,290.7	—	1,366.0	—	248.8	—
1940.......	1,335.1	—	1,303.5	—	317.2	—
1941.......	1,329.9	—	1,325.6	—	488.4	—
1942.......	1,287.9	—	1,348.2	—	632.6	—
1943.......	1,238.7	—	1,371.1	—	766.0	—
1944.......	1,210.9	—	1,330.0	—	786.4	—
1945.......	1,195.0	1,691.5	1,304.1	4,190.6	792.8	4,983.4
1946.......	1,251.3	1,679.7	1,284.6	4,215.6	772.9	4,988.5
1947.......	1,339.8	1,681.8	1,267.8	4,289.4	748.8	5,038.2
1948.......	1,448.8	1,701.6	1,263.6	4,144.0	735.2	5,149.2
1949.......	1,557.2	1,731.5	1,255.1	4,543.9	700.0	5,243.8
1950.......	1,651.6	1,774,4	1,259.2	4,685.2	662.9	5,348.1
1951.......	1,755.1	1,873.5	1,273.3	4,901.9	629.8	5,531.7
1952.......	1,890.4	2,036.4	1,320.2	5,247.0	619.4	5,866.4
1953.......	1,986.0	2,167.1	1,403.4	5,556.5	604.0	6,160.5
1954.......	2,088.5	2,273.0	1,467.8	5,829.3	576.8	6,406.1
1955.......	2,197.3	2,394.9	1,570.0	6,162.2	539.3	6,701.5

Table 6B. 6 (Cont'd.)

7000 : Social Capital — Net Stock (Cont'd.)

	7809 : Housing construction	7900 : Institutions[a]			7000 : Total social capital		
		Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	—	—	48.6	—	—	—	—
1927	—	—	51.0	—	—	—	—
1928	—	—	53.9	—	—	—	—
1929	—	—	58.2	—	—	—	—
1930	—	—	64.9	—	—	—	—
1931	—	—	69.8	—	—	—	—
1932	—	—	70.0	—	—	—	—
1933	—	—	66.1	—	—	—	—
1934	—	—	62.1	—	—	—	—
1935	—	—	58.2	—	—	—	—
1936	—	—	55.2	—	—	—	—
1937	—	—	53.2	—	—	—	—
1938	—	—	52.3	—	—	—	—
1939	—	—	51.7	—	—	—	—
1940	—	—	48.8	—	—	—	—
1941	—	—	45.4	—	—	—	—
1942	—	—	41.8	—	—	—	—
1943	—	—	39.2	—	—	—	—
1944	—	—	38.3	—	—	—	—
1945	8,756.7	1,195.9	40.9	1,236.8	14,143.2	833.7	14,976.9
1946	9,004.8	1,233.9	48.5	1,282.4	14,454.3	821.4	15,275.7
1947	9,342.2	1,276.5	58.0	1,334.5	14,908.1	806.8	15,714.9
1948	9,720.7	1,356.6	75.1	1,431.7	15,491.3	810.3	16,301.6
1949	10,153.0	1,472.1	91.0	1,563.1	16,168.9	791.0	16,959.9
1950	10,598.1	1,591.2	107.3	1,698.5	16,874.5	770.2	17,644.7
1951	10,911.1	1,708.8	123.6	1,832.4	17,521.8	753.4	18,275.2
1952	11,197.4	1,843.6	141.2	1,984.8	18,288.0	760.6	19,048.6
1953	11,656.7	1,981.9	156.7	2,138.6	19,195.1	760.7	19,955.8
1954	12,171.9	2,137.5	177.0	2,314.5	20,138.7	753.8	20,892.5
1955	12,891.3	2,340.3	192.9	2,533.2	21,393.8	732.2	22,126.0

[a] Includes schools, universities, churches, hospitals.

Table 6B. 7

"INDUSTRY" — GROSS STOCK AND NET STOCK BY DIRECT CUMULATION, IN 1949 PRICES AND AT ORIGINAL COST, 1926-55

8002 : "Industry" Direct Cumulation
A : 1949 prices

	Gross stock			Net stock		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926......	15,986.2	6,238.0	22,224.2	9,266.4	3,166.2	12,432.6
1927......	16,259.3	6,136.6	22,395.9	9,356.2	3,286.5	12,642.7
1928......	16,703.7	6,063.3	22,767.0	9,610.5	3,495.6	13,106.1
1929......	17,244.4	6,292.1	23,536.5	9,950.0	3,801.8	13,751.8
1930......	17,633.1	6,623.1	24,256.2	10,124.0	3,970.8	14,094.8
1931......	17,837.9	6,676.4	24,514.3	10,129.7	3,870.2	13,999.9
1932......	17,807.4	6,543.7	24,351.1	9,895.0	3,611.7	13,506.7
1933......	17,708.1	6,355.0	24,063.1	9,592.2	3,321.4	12,913.6
1934......	17,633.6	6,181.9	23,815.5	9,316.7	3,104.2	12,420.9
1935......	17,603.5	6,035.9	23,639.4	9,087.5	2,947.4	12,034.9
1936......	17,502.4	5,922.0	23,424.4	8,909.2	2,856.8	11,766.0
1937......	17,688.1	6,032.9	23,721.0	8,775.7	2,917.1	11,692.8
1938......	17,862.5	6,037.2	23,899.7	8,612.1	2,961.9	11,574.0
1939......	18,017.5	6,043.3	24,060.8	8,432.7	2,969.5	11,402.2
1940......	18,128.9	6,230.3	24,359.2	8,291.0	3,172.4	11,463.4
1941......	18,292.7	6,537.8	24,830.5	8,222.5	3,476.5	11,699.0
1942......	18,409.4	6,680.2	25,089.6	8,180.6	3,719.2	11,899.8
1943......	18,298.9	6,637.9	24,936.8	7,980.5	3,849.8	11,830.3
1944......	18,170.8	6,660.6	24,831.4	7,767.0	4,140.4	11,907.4
1945......	18,119.7	6,769.1	24,888.8	7,641.1	4,393.4	12,034.5
1946......	18,105.1	7,204.0	25,309.1	7,732.6	4,717.9	12,450.5
1947......	18,159.0	8,215.7	26,374.7	7,939.5	5,435.9	13,375.4
1948......	18,407.4	9,357.9	27,765.3	8,271.9	6,176.3	14,448.2
1949......	18,583.6	10,461.4	29,045.0	8,638.2	6,862.4	15,500.6
1950......	18,821.8	11,495.6	30,317.4	9,067.6	7,454.5	16,522.1
1951......	19,005.4	12,663.9	31,669.3	9,589.4	8,168.2	17,757.2
1952......	19,384.2	13,822.6	33,206.8	10,256.9	8,937.7	19,194.6
1953......	19,810.5	15,091.8	34,902.3	10,969.7	9,732.4	20,702.1
1954......	20,297.3	16,200.9	36,498.2	11,652.4	10,245.5	21,897.9
1955......	20,902.6	17,137.6	38,040.2	12,333.2	10,707.9	23,041.1

Table 6B. 7 (Cont'd.)

8002 : "Industry" Direct Cumulation (Cont'd.)

B : At original cost

	Gross stock			Net stock		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926......	5,935.8	4,193.2	10,129.0	4,293.3	2,321.1	6,614.4
1927......	6,215.8	4,249.5	10,465.3	4,429.9	2,367.6	6,797.5
1928......	6,610.8	4,322.7	10,933.5	4,674.5	2,458.3	7,132.8
1929......	7,081.8	4,557.5	11,639.3	4,985.2	2,609.1	7,594.3
1930......	7,440.8	4,786.5	12,227.3	5,172.2	2,654.3	7,826.5
1931......	7,682.2	4,790.7	12,472.9	5,233.2	2,529.2	7,762.4
1932......	7,788.6	4,591.1	12,379.7	5,153.1	2,315.8	7,468.9
1933......	7,858.0	4,341.8	12,199.8	5,033.4	2,091.7	7,125.1
1934......	7,939.4	4,123.9	12,063.3	4,923.9	1,917.2	6,841.1
1935......	8,047.8	3,842.7	11,890.5	4,839.4	1,787.3	6,626.7
1936......	8,156.1	3,678.2	11,834.3	4,782.2	1,710.1	6,492.3
1937......	8,312.4	3,730.0	12,042.4	4,760.3	1,743.9	6,504.2
1938......	8,451.8	3,680.8	12,132.6	4,714.5	1,769.2	6,483.7
1939......	8,580.3	3,649.0	12,229.3	4,657.2	1,774.8	6,432.0
1940......	8,715.5	3,771.0	12,486.5	4,627.7	1,929.5	6,557.2
1941......	8,906.7	4,019.0	12,925.7	4,656.8	2,186.1	6,842.9
1942......	9,131.7	4,187.0	13,318.7	4,738.1	2,412.2	7,150.3
1943......	9,267.2	4,253.0	13,520.2	4,747.8	2,573.1	7,320.9
1944......	9,343.1	4,366.0	13,709.1	4,697.1	2,841.6	7,538.7
1945......	9,466.9	4,530.0	13,996.9	4,697.5	3,063.5	7,761.0
1946......	9,707.3	4,914.0	14,621.3	4,874.8	3,339.5	8,214.3
1947......	10,069.3	5,817.0	15,886.3	5,193.1	4,020.9	9,214.0
1948......	10,646.1	6,951.0	17,597.1	5,694.4	4,849.1	10,543.5
1949......	11,256.7	8,146.0	19,402.7	6,249.2	5,695.7	11,944.9
1950......	11,966.6	9,364.0	21,330.6	6,897.8	6,515.6	13,413.4
1951......	12,860.9	10,936.0	23,796.9	7,771.6	7,642.1	15,413.7
1952......	14,096.5	12,558.0	26,654.4	8,958.1	8,814.2	17,772.3
1953......	15,379.0	14,340.0	29,719.0	10,181.7	10,033.0	20,214.7
1954......	16,639.6	15,912.0	32,551.6	11,311.2	10,900.0	22,211.2
1955......	18,029.8	17,365.0	35,394.8	12,496.2	11,690.2	24,186.4

Table 6B. 8

INVESTMENT, GROSS STOCK AND NET STOCK IN 1949 PRICES "TOTAL MANUFACTURING", 1926-55

4400 : "Total Manufacturing"

	Investment			Gross stock			Net stock		
	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total	Construction	Machinery and equipment	Total
1926	91.7	119.0	210.7	2,304.1	1,281.2	3,585.3	1,590.9	695.3	2,286.2
1927	146.3	153.6	299.9	2,438.1	1,383.9	3,822.0	1,679.6	777.7	2,457.3
1928	199.9	154.7	354.6	2,625.7	1,473.6	4,099.3	1,818.5	855.5	2,674.0
1929	207.3	150.5	357.8	2,820.7	1,546.7	4,367.4	1,960.2	924.1	2,884.3
1930	124.4	151.7	276.1	2,932.8	1,600.3	4,533.1	2,014.1	989.9	3,004.0
1931	72.9	93.6	166.5	2,992.0	1,592.5	4,584.5	2,013.7	994.6	3,008.3
1932	34.8	46.4	81.2	3,013.1	1,559.5	4,572.6	1,973.7	952.5	2,926.2
1933	34.2	52.7	86.9	3,033.6	1,556.9	4,590.5	1,932.6	918.6	2,851.2
1934	36.6	64.3	100.9	3,056.5	1,562.2	4,618.7	1,893.4	896.4	2,789.8
1935	38.9	76.4	115.3	3,081.7	1,590.8	4,672.5	1,855.9	886.0	2,741.9
1936	68.1	76.2	144.3	3,113.6	1,619.2	4,732.8	1,847.0	873.8	2,720.8
1937	108.2	117.6	225.8	3,218.9	1,679.2	4,898.1	1,877.4	901.4	2,778.8
1938	77.0	108.5	185.5	3,295.1	1,721.9	5,017.0	1,873.9	916.6	2,790.5
1939	58.1	98.2	156.3	3,351.6	1,753.6	5,105.2	1,849.6	919.1	2,768.7
1940	111.4	258.2	369.6	3,438.4	1.947.2	5,385.6	1,877.2	1,079.9	2,957.1
1941	150.5	328.8	479.3	3,569.8	2,204.7	5,774.5	1,941.7	1,300.5	3,242.2
1942	202.8	319.4	522.2	3,723.2	2,451.2	6,174.4	2,055.3	1,497.4	3,552.7
1943	119.4	197.6	317.0	3,778.2	2,567.4	6,345.6	2,081.6	1,558.8	3,640.4
1944	84.9	187.5	272.4	3,807.3	2,635.9	6,443.2	2,072.0	1,603.7	3,675.7
1945	105.2	264.1	369.3	3,865.1	2,746.4	6,611.5	2,082.0	1,721.4	3,803.4
1946	172.7	261.3	434.0	3,937.3	2,853.0	6,790.3	2,158.1	1,830.1	3,988.2
1947	215.7	397.6	613.3	4,069.0	3,100.1	7,169.1	2,275.4	2,069.2	4,344.6
1948	191.2	418.2	609.4	4,156.7	3,366.6	7,523.3	2,364.9	2,315.2	4,680.1
1949	157.2	380.3	537.5	4,218.2	3,653.3	7,871.5	2,418.2	2,508.5	4,926.7
1950	128.8	335.4	464.2	4,279.8	3,942.3	8,222.1	2,652.5	2,640.9	5,293.4
1951	225.3	442.5	667.8	4,380.5	4,332.1	8,712.6	2,770.8	2,864.4	5,635.2
1952	269.4	550.0	819.4	4,576.9	4,817.8	9,394.7	2,930.7	3,173.7	6,104.4
1953	245.3	545.4	790.7	4,741.4	5,286.8	10,028.2	3,061.6	3,451.4	6,513.0
1954	232.5	442.9	675.4	4,883.3	5,653.5	10,536.8	3,175.6	3,600.6	6,776.2
1955	253.2	451.5	704.7	5,090.3	5,987.4	11,077.7	3,306.7	3,738.0	7,044.7

Table 6B. 9

CAPITAL-OUTPUT RATIOS FOR STRUCTURES, MACHINERY AND EQUIPMENT, AND TOTAL GROSS STOCK IN 1949 PRICES, 1926-55

	Industrial Gross Domestic Product	Industrial fixed gross stock			Capital-output ratios		
		Construction	Machinery and equipment	Total	Construction ratio	Machinery and equipment ratio	Total ratio
1926........	7,013	15,986.2	6,238.0	22,224.2	2.280	.889	3.169
1927........	7,512	16,259.3	6,136.6	22,395.9	2.164	.817	2.981
1928........	8,158	16,703.7	6,063.3	22,767.0	2.048	.743	2.791
1929........	7,751	17,244.4	6,292.1	23,536.5	2.225	.812	3.037
1930........	7,574	17,633.1	6,623.1	24,256.2	2.328	.874	3.202
1931........	6,616	17,837.9	6,676.4	24,514.3	2.696	1.009	3.705
1932........	6,201	17,807.4	6,543.7	24,351.1	2.872	1.055	3.927
1933........	5,498	17,708.1	6,355.0	24,063.1	3.221	1.156	4.377
1934........	6,079	17,633.6	6,181.9	23,815.5	2.901	1.017	3.918
1935........	6,525	17,603.5	6,035.9	23,639.4	2.698	.925	3.623
1936........	6,833	17,502.4	5,922.0	23,424.4	2.561	.867	3.428
1937........	7,438	17,688.1	6,032.9	23,721.0	2.378	.811	3.189
1938........	7,456	17,862.5	6,037.2	23,899.7	2.396	.810	3.206
1939........	8,068	18,017.5	6,043.3	24,060.8	2.233	.749	2.982
1940........	9,104	18,128.9	6,230.3	24,359.2	1.991	.684	2.675
1941........	10,049	18,292.7	6,537.8	24,830.5	1.820	.650	2,470
1942........	11,961	18,409.4	6,680.2	25,089.6	1.539	.558	2.097
1943........	11,526	18,298.9	6,637.9	24,936.8	1.588	.576	2.164
1944........	12,162	18,170.8	6,660.6	24,831.4	1.494	.548	2.042
1945........	11,098	18,119.7	6,769.1	24,888.8	1.633	.610	2.243
1946........	11,341	18,105.1	7,204.0	25,309.1	1.596	.635	2.231
1947........	11,929	18,159.0	8,215.7	26,374.7	1.522	.689	2.211
1948........	12,361	18,407.4	9,357.9	27,765.3	1.489	.757	2.246
1949........	12,595	18,583.6	10,461.4	29,045.0	1.475	.830	2.305
1950........	13,420	18,821.8	11,495.6	30,317.4	1.402	.857	2.259
1951........	14,285	19,005.4	12,663.9	31,669.3	1.330	.886	2.216
1952........	15,040	19,384.2	13,822.6	33,206.8	1.289	.919	2.208
1953........	15,614	19,810.5	15,091.8	34,902.3	1.269	.966	2.235
1954........	14,959	20,297.3	16,200.9	36,498.2	1.357	1.083	2.440
1955........	16,434	20,902.6	17,137.6	38,040.2	1.272	1.043	2.315

Chapter 6, Appendix C

The table at the end of this Appendix is intended to summarize the sources of the original expenditure data, the price indexes used to bring the original data into 1949 prices, and finally, the assumed service life attributed to the investment expenditures of the various industries.

In the immediately following pages, we will present brief notes on matters which are relevant to the detailed tables. The headings refer to the column numbers in the table.

Columns 1 and 2: Industry and Code Number

Column 1 contains the numbers which we have assigned to the various industries, and the consolidation of those industries or sectors. As a matter of convenience, these numbers also apply to the filing system which was used in the computation and consolidation of the estimates. Furthermore, the numbers are adapted directly from the Standard Industrial Classification (S.I.C.) For example, forestry, which is here given the number 2,080, is in the S.I.C. given the number 80; and electric light and power, which here is numbered 2,602, is in the S.I.C. numbered 602. It will be seen then that the numbers used are in both cases the same as those in the S.I.C. as far as the three right-hand digits are concerned. The first digit is used to identify the sector in which the industry has been placed, thus:

I.	Agriculture	1,000
II.	Resource industries	2,000
III.	Primary manufacturing	3,000
IV.	Secondary manufacturing	4,000
V.	Transport, storage and communication	5,000
VI.	Trade, services and construction	6,000
VII.	Government, community services and housing (social capital)	7,000
VIII.	Total Industrial Economy (Sectors I-VI).	8,000

These sectors are defined as far as statistical data will allow in the same way as the sectors used in the division of the G.D.P. at factor cost, the labour force in other parts of this study, and, indeed, in other parts of the Commission's work. For recapitulation it is necessary only to refer to the table at the end of the Appendix which shows the main industry groups placed under each of the seven sectors.

Rather more doubt about classification may occur to those who are interested in manufacturing. The following classification is that which has been used throughout the work of the Royal Commission on the division of manufacturing industries as between primary manufacturing and secondary manufacturing.

DIVISION OF MANUFACTURING CLASSIFICATION BY SUB-GROUPS

Primary	*Secondary*	
		Foods and Beverages
x		Canning and processing
x		Dairy products
x		Grain mill products
x		Meat products
	x	Bakery products
	x	Beverages
	x	Other food industries
		Tobacco and Tobacco Products
	x	Tobacco, cigars and cigarettes
	x	Tobacco processing and packing
		Rubber Products
	x	
		Leather Products
	x	Footwear, leather
	x	Gloves and mittens, leather
	x	Leather tanning
	x	Other leather industries
		Textile Products (except clothing)
	x	Cotton goods
	x	Woollen goods
	x	Synthetic textiles and silk
	x	Other primary textiles
	x	Other textile industries

Primary	Secondary	
		Clothing (textile and fur)
	x	Men's, women's and children's clothing
	x	Knitted goods
	x	Miscellaneous clothing
		Wood Products
x		Saw and planing mills
	x	Furniture
	x	Other wood industries
		Paper Products
x		Pulp and paper
	x	Boxes and bags, paper
	x	Roofing paper
	x	Miscellaneous paper goods
		Printing, Publishing and Allied Industries
	x	Commercial printing
	x	Engraving, stereotyping and allied industries
	x	Printing and publishing
		Iron and Steel Products
	x	Agricultural implements
	x	Boilers, tanks and platework
	x	Bridge building and structural steel
	x	Casting, iron
	x	Hardware, tools and cutlery
	x	Heating and cooking apparatus
	x	Machinery, household, office and store
	x	Machinery, industrial
	x	Machine shops
	x	Machine tools
	x	Primary iron and steel
	x	Sheet metal products
	x	Wire and wire goods
	x	Miscellaneous iron and steel products
		Transportation Equipment
	x	Aircraft and parts
	x	Bicycles and parts
	x	Boat building

Primary	Secondary	
	x	Carriages, wagons and sleighs
	x	Motor vehicles
	x	Motor vehicle parts
	x	Railway rolling stock
	x	Shipbuilding
		Non-Ferrous Metal Products
x		Non-ferrous metal smelting and refining
	x	Aluminum products
	x	Brass and copper products
	x	Jewellery and silverware
	x	White metal alloys
	x	Miscellaneous non-ferrous metal products
		Electrical Apparatus and Supplies
	x	Batteries
	x	Radios and radio parts
	x	Refrigerators, vacuum cleaners and appliances
	x	Machinery, heavy electrical
	x	Miscellaneous electrical apparatus and supplies
		Non-Metallic Mineral Products
x		Abrasives (artificial)
x		Cement, hydraulic
	x	Salt
	x	Stone products
	x	Asbestos products
	x	Clay products from domestic clay
	x	Clay products from imported clay
	x	Concrete products
	x	Glass and glass products
	x	Gypsum products
	x	Lime
	x	Sand-Lime brick
	x	Miscellaneous non-metallic mineral products
		Products of Petroleum and Coal
	x	Coke and gas products
	x	Petroleum products
	x	Miscellaneous products of petroleum coal

Primary	Secondary	
		Chemicals and Allied Products
x		Acids, alkalies and salts
x		Fertilizers
x		Primary plastics
	x	Medicinal and pharmaceutical preparations
	x	Paints, varnishes and lacquers
	x	Soaps, washing compounds and cleaning preparations
	x	Toilet preparations
	x	Vegetable oils
	x	Other chemical industries
		Miscellaneous Industries
	x	Brooms, brushes and mops
	x	Blocks, watches and watch cases
	x	Fountain pens and pencils
	x	Musical instruments
	x	Plastic products
	x	Scientific and professional equipment
	x	Sporting goods
	x	Toys and games
	x	Typewriter supplies
	x	Other miscellaneous industries

Columns 3 and 4: Sources of Expenditure Data at Original Cost

We give below in what is roughly decreasing order of frequency of use, the sources consulted in order to obtain on a consistent basis investment information for the industries used.

(1) *(PPI): Private and Public Investment in Canada, 1926-1951.* Department of Trade and Commerce, November, 1951.

This work is the main source of information for the investment series used in the cumulations. It presents a remarkably complete set of data, industry by industry, for the whole Canadian economy for the years 1926-51. The information for each industry is divided, first, between new investment and repair and maintenance expenditure; only the former, new investment, has been used in the present study. Secondly, there is a distinction between new investment in construction and new investment in machinery and equipment. We have maintained this distinction.

The distinction between construction and machinery and equipment is discussed in *PPI* at page 21 and again at page 212 and 213. Roughly speak-

ing the distinction coincides with that between buildings and equipment to be found in many balance sheets. However, the word "construction" also covers engineering products such as highways, dams and indeed, exploration expenditures by mining and oil enterprises. Furthermore, construction is used to include work done in installing heating and ventilating equipment and elevators, and such items as are considered to be an integral part of the structure.

In addition to outlays for new buildings and structures, the construction estimates include expenditures made on major improvements to existing structures. A major improvement to a building is considered to be any work that involves the structural alteration of building, such as the addition of a new wing or an additional storey or similar substantial change affecting the quality or the layout of the structure. In the case of major improvements to highways the concept is somewhat different. The resurfacing or rebuilding of any extended length of street or highway is considered to be a major improvement.

Investment in machinery equipment includes the *installed* cost of machinery, motors, etc. and the delivered cost of office furniture and fixtures, motor vehicles and other transportation equipment.

The user of the following estimates is urged to consult the discussion on pages 212-213, where most of the crucial decisions made by Dr. O. J. Firestone and his associates are set forth.

In several of the industries used in the present study, an adjustment has been made to the figures published in *PPI* for the years 1926-32. This adjustment is necessary because of what is evidently an error in the table covering the food and beverage industries—Table 27, page 158. In column 2, the published figures begin with 80.9. Beginning with 1926 the correct machinery and equipment figures are as follows: 8.1; 9.0; 9.7; 13.1; 10.0; 5.4; 3.1. The 1933 figure is correct as it stands. It will be seen that the error created an entirely illusory picture of growth in the food and beverage industry in the late 1920's. See also the graph on page 47.

Unfortunately, this error, being quite substantial, is reflected in the corresponding figures for Table 26, All Manufacturing Industries. Beginning with 1926 the corrected figures are as follows: 73.6; 92.1; 92.8; 93.5; 87.4; 54.4; 27.8. The figure for 1933 is correct. Minor echoes of the error will also be found in tables where the size of manufacturing investment was used as a guide in making estimates in this early period. The chief of these is Table 39, Miscellaneous Manufacturing Industries, including an allowance for capital items charged to operating expenses in all manufacturing industries. The corrected figures for column 2 of this table, beginning with 1926, are as follows: 15.7; 19.6; 19.8; 19.9; 18.6; 11.6; 5.9. The method by which this table was constructed is given in *PPI*, page 223, last column.

It will be seen on page 228 that the estimate for warehousing was made on the basis of the trend of business investment over the period 1926-45. However, warehousing investment expenditures are relatively very small, so that no new adjustment was necessary to correct for the error originating in the food and beverage industry.

On the same page it will be seen that in Tables 67 to 69, on trade, finance and commercial services, respectively, the estimates of total new investment were distributed between construction and equipment by using a ratio of construction to machinery and equipment expenditures for all industries. Since this ratio was incorrect in 1926-32, the figures for trade and for finance have been altered to change the ratio in the first two columns. By our calculations, Table 67, column 1, construction, should begin in 1926 as follows: 14.9; 16.4; 31.5; 41.9; 27.2; 17.6; 11.5. Column 2, machinery and equipment, therefore runs from 1926 as follows: 8.8; 10.7; 18.8; 25.8; 15.4; 7.5; 5.0.

In Table 68, finance, similar changes are necessary. Column 1, construction, beginning in 1926 should run as follows: 6.1; 10.8; 11.5; 15.8; 11.2; 9.4; 6.8. Column 2, machinery and equipment, should be revised as follows: 1.5; 2.8; 2.7; 3.8; 2.6; 1.7; 1.3.

On page 228 it is implied that commercial services, as given in Table 69, are also governed by the ratio of construction to machinery and equipment for all industries. However, we are informed that this ratio was not actually used, and that other information which was available for the early '30's was used as the source of ratio for the late '20's. The commercial services' table, in other words, is correct as it stands.

(2) *(Outlook): Private and Public Investment in Canada*

This publication is issued jointly by the Dominion Bureau of Statistics and the Economics Division of the Department of Trade and Commerce. It continues the classifications and categories of *PPI* using information gathered in an annual investment survey. The categories are, for the most part, completely comparable with others in *PPI*, except that rather more detail is introduced from year to year in the *Outlook*. For example, the authors of *PPI* did not distinguish between the non-ferrous metal products industry and the electric apparatus and supplies industry, but users of the *Outlook* will find distinct estimates for these two industries. It may be useful here briefly to discuss the difference between the techniques underlying *PPI* and the *Outlook*. In *PPI* different methods of estimation for the period 1926-45 were used for the various sectors of the economy. The methods are set forth in Appendix A, and do not need discussion here. It should be remarked that the most important method for this period is that given on page 223 of *PPI*, where it is explained how the tax records of companies were used as

the basis for estimating the investment expenditures by various industry groups. The quality of the estimates is assessed by their authors on page 224, and in the paper presented by Kenneth Buckley to the Conference on Research in Income and Wealth at the National Bureau of Economic Research in New York, October, 1953. On page 42, Professor Buckley undertakes to compare the estimates of *PPI* with those of other sources, including his own (see No. 4). Professor Buckley shows great and warranted concern over the difference between *PPI* machinery estimates for the year 1926 and that in other sources, and argues that since this difference changes radically between 1926 and the middle '30's, it must indicate a bias in either *PPI* or the alternative sources. However, as discussed above, this discrepancy is probably for the most part attributable to the error in the food and beverage estimates in the original *PPI* publication, which not only raises the 1926-32 level, but changes its level at the year 1933 when the error ceases, thus giving the impression of a bias in *PPI* which, apart from this error, we believe does not exist.

From 1945 to 1950, the *PPI* sources are the same as those which now appear in the *Outlook:* the annual investment survey, enquiring of each enterprise the quantity of investment expenditures made in the preceding, current and forecasting year. Since the investment survey underlying the *Outlook* is made annually and currently, it is likely to be falsified by changes in plans, or the inability of corporations to carry through their plans. For this reason, both the figure forecast and the current "preliminary actual" estimate published each year are not completely reliable. (This comment applies also to the figures for the year 1950-51, included in the tables in *PPI*, as these two were merely forecasts and current estimates for the year in which *PPI* was prepared.) Consequently, it has been necessary to use the earliest of the three figures published each year for each industry in the *Outlook* series in order to obtain the investment expenditure which actually took place under each of the industrial categories. In the great majority of cases (but not all) we have used for 1955 the 1955 "preliminary actual" estimates from the 1956 *Outlook*.

(3) (ES, T&C): These initials stand for the Economic Section of the Department of Trade and Commerce, as well as the General Assignment Division of the Dominion Bureau of Statistics.

The *Outlook* publication is the joint product of these two offices, the General Assignments Division of D.B.S. taking chief responsibility for obtaining and processing the information supplied by each enterprise, while analysis and publication are undertaken in the Economics Section of the Department of Trade and Commerce.

The information supplied by these two offices has been of two distinct kinds:

(a) We have obtained rather more detail than is given in *PPI* for the historical period 1926-45, but for the most part this has consisted of finer detail for the public utility industries, information about capital expenditures out of operating revenues, and miscellaneous information on methods used to obtain the original data.

(b) Since 1945 the survey underlying the *Outlook* has been published in a classification more or less the same as that of the original *PPI*. However, in some industries more detailed information has been available, and the appearance of the initials ES T&C below is an acknowledgment of the frequent use we have made of the specially obtained figures for manufacturing and utility industries.

This information has been valuable, not only for the years 1945-55, but also for the earlier period. As will appear below, we have applied the ratio of investment in our primary manufacturing to that in secondary manufacturing in these postwar years to the earlier *PPI* information, in order to obtain over the whole period separate categories of private and public investment.

There is no way of knowing whether these ratios are actually valid for the earlier period. We are fairly satisfied, however, that in the cases of pulp and paper, and wood and its products, the great majority of investment was in the primary part of the two industries. Furthermore, we have nowhere obtained any indication that our division of food and beverages, which is roughly 40% primary and 60% secondary, non-ferrous metals about 50-50, or chemical products also about 50-50, is seriously in error for the earlier period. Since, as will be seen above, our classification assigns all of industries such as petroleum and coal, to secondary manufacturing, we also feel quite confident that the primary part of non-metallic minerals, which is chiefly the cement industry, is not much larger than the 15% assigned below.

(4) (Buckley): Kenneth Buckley, *Capital Formation in Canada, 1896-1930*, Canadian Studies in Economics, No. 2, University of Toronto Press, 1955.

We have relied very heavily upon this work to carry back the various tables or consolidation of tables from *PPI* to the period 1896. The bulk of the information is to be found in Tables A to P at the end of the volume, and the methods covering these tables in Chapters 7 to 11. Chapters 1 to 6 of this most interesting study present analyses of the investment figures in terms of the general growth of the Canadian economy. Some discussion of this book is also implicit in Professor Buckley's paper delivered at the National Bureau of Economic Research, which is referred to in (2)

above. In this paper, Professor Buckley relates his own estimates to those in *PPI* by contrasting methods and levels in the overlapping years 1926-30. The method used by Professor Buckley did not permit classifying his construction or machinery estimates by fine industrial category such as are to be found in *PPI*. Indeed, his method is by intention similar to that in *PICF*, which is also discussed later. Therefore, many of our individual industries series from *PPI*, commencing in 1926, cannot be carried back to an earlier year. As will be seen, this is not particularly important for machinery and equipment estimates, since the series beginning in 1926 is quite satisfactory for producing a stock calculation by 1945.

However, construction figures need a run of 40 or 50 years before they can be usefully cumulated. For various industries it was possible to carry the *PPI* figures back directly for the necessary interval, but for most manufacturing industries this was impossible. Hence, the procedure outlined in 8003 was followed. Within each sector the construction series, which could not by any other means be carried earlier than 1926, were added together and carried back in constant dollars to 1896, as what we have called our "Residual Construction Series". This series was given this name because it consisted of Buckley's construction series for the whole economy, reduced by having substracted from it all other information that is available, viz: investment in housing, by railways, by government, and by agriculture, power, forestry, mining, pulp and paper, saw milling, telephones and waterworks. By using this indicator we have produced a construction series which is probably erroneous when applied to any particular industry in the years preceding 1926. However, in any particular sector the cumulation procedure, because of the growth of investment in the whole economy, gives relatively little weight to the figures preceding 1926 and a great deal of weight to the estimates of subsequent years. By 1950 we believe for the whole economy the average age of the stock was less than 24 years; that is, if we go back 24 years prior to 1950 we will find that more than half of the stock of construction goods existing in 1950 had not yet been installed. In the net capital series even less emphasis is given to the investment expenditure of years prior to 1926.

(5) *(PICF): Public Investment and Capital Formation, A Study of Public and Private Investment Outlay, Canada, 1926-41,* prepared for the Dominion-Provincial Conference on Reconstruction, August, 1945.

This publication presents for selected years between 1926-41 estimates prepared by a commodity flow method similar to that of the National Bureau of Economic Research. This method is epitomized by the well-known work of Dr. Simon Kuznets, *Commodity Flow and Capital Formation,* (New York, 1939). Its approach, therefore, is on the whole different from that of *PPI*, in that it traces investment goods from their manufacture or importation until

they are installed by the various industries of government (*PICF* gives most attention to government). Consequently, the information of investment by the various industries is rather scanty, although the detail on types of government expenditure is usually full. Many of the estimates made in *PICF* have been carried more or less intact into *PPI*, especially in the non-manufacturing industries. *PICF* is also important in the present study because it contains the concepts and categories which were adopted by Buckley and carried back to 1896. Much of the National Bureau paper by Professor Buckley is devoted to the relationships between *PICF* and his own estimates.

(6) (Domestic Supply)

This phase, occurring frequently below, e.g. mining, quarrying and oil wells, refers to a technique which, if done carefully and in detail, is the same as that which underlies *PICF* and Buckley. However, in the present study, the domestic supply indexes, as will be seen, have been computed fairly roughly in order to indicate merely the level and trend of investment by a few industries for the years prior to 1926.

The technique has been useful only where the type of equipment used by the industry can be easily identified. For example, "pulp and paper machinery" is used chiefly by the pulp and paper industry; "mining machinery" by the mining industry; and "generators and turbines" by the central electric industry (unfortunately for accuracy, also by the pulp and paper and mining industries). Most industries by contrast use machinery and equipment which is not specific to them; for example, motors, boilers, lathes, blowers, pumps, scales and conveying equipment. To repeat, therefore, only where the foreign trade and production statistics identify machinery by roughly the same name as the buying industry was the domestic supply technique used.

The domestic supply series shows the output of capital goods from Canadian industries, plus the flow of imported capital goods from abroad. The flow is measured in current dollars, since the intention of the series is to carry to earlier than 1926 the 1926 *PPI* figures which is also given in current dollars. Information on production by Canadian capital goods industries is generally available only since the beginning of the Canadian census of industry; that is, since about 1918. Hence, an index of domestic supply is in most cases an index of imports in the years previous to World War I. The import data were derived from *Trade of Canada* for various years. (In some years *Trade of Canada* presents import data by calendar years, and in other periods by fiscal years. The fiscal-year data have been adjusted to a calendar-year basis.)

One of the chief problems of statisticians using the domestic supply (or commodity flow) method is to judge the expense to purchasers of this equipment, in addition to that shown in trade or production statistics, arising from

tariffs, indirect taxes, transportation, and wholesalers' markups. It should be emphasized here that we have made no attempt whatsoever to estimate changes in these highly important costs. In effect, all costs other than those shown in production or trade statistics are taken as being a constant proportion of production or trade value.

Columns 5 and 6: Price Indexes

In columns 5 and 6 are given, by code number, the price index or price deflator which was used to bring the value figures described in columns 3 and 4 to a 1949 price-level basis.

The dangers and cautions to be remembered in using any price index for capital goods have already been mentioned in Chapter 6. It is necessary here merely to describe the sources of the price indexes which are mentioned by number in columns 5 and 6. The numbering of these price indexes was simply one of our own convenience, and does not refer to the standard industrial classification nor to the order of importance.

The price indexes numbered 1 to 17 are American implicit price deflators for producers' durable equipment. Although such deflators are available from various sources, all those used here are published in the *Survey of Current Business* for November, 1953, in an article by Robert C. Wasson entitled "Investment in Production Equipment, 1929-52". A footnote to the article tells us that the price indexes underlying the deflators were produced by John W. Kendrick. These price indexes for the individual products of the capital goods industries have been weighted together so that they cover the equipment used by various industries in the American Standard Industrial Classification. For that reason they suit well the deflation of investment expenditures by Canadian industries on American equipment.

The indexes used in our table below are selected from Table 7 of the article as follows:

1. Total Producers Durable Equipment
2. Fabricated Metal Products
3. Tractors
4. Construction Machinery
5. Mining and Oil Field Machinery
6. Metal-Working Machinery
7. Special Industry Machinery
8. General Industrial Machinery
9. Office and Store Machinery
10. Service-Industry and Household Machines
11. Electrical Machinery
12. Trucks, Buses and Trailers
13. Passenger Cars

14. Aircraft
15. Ships and Boats
16. Railroad Equipment
17. Instruments

By referring to the article and the American Standard Industrial Classification, the reader may obtain a full list of the types of machinery which are grouped together under the above headings. Two adjustments were made in order that these deflators might be used in connection with Canadian investment expenditures.

(a) Extending the dates back to 1926 and forward to 1955. Without exception these indexes were carried back from 1929 to 1926 using the trend of an index for deflating machinery and equipment purchased in the United States in the Canadian *National Accounts.* This index is as follows:

1926 = 100.8
1927 = 96.5
1928 = 96.7
1929 = 100.0

To carry the indexes on to 1955 the following trend was used for all American machinery price indexes:

1952 = 100
1953 = 103.7
1954 = 104.4
1955 = 108.0

(b) The converting of American prices into Canadian prices. We obtained from D.B.S. Research and Development Division an adjustment factor which registered the ratio between American and Canadian prices in terms of the duty on capital goods imported into Canada, the war excise tax, where applicable, sales tax, excise and the changing rate of exchange.

The United States indexes were first carried back to 1926 as described in (a) above, then adjusted for the factor described in (b). They were then converted into 1949 Canadian dollars and pushed forward to 1955 as also described in (a) above.

The remainder of the price indexes are Canadian in origin, and refer for the most part to capital goods made in Canada. Those appearing immediately below were obtained from D.B.S. Research and Development Division, where they are used in deflating the investment expenditure items in the National Accounts. The three indexes which follow are in a sense "factor cost" price indexes, in that they are not implicit price deflators but are derived by weighting together the chief constituent materials and the

appropriate labour expenses for the kind of investment expenditure they are intended to deflate.

18. Non-Residential Building Construction
19. Engineering Construction other than that in 20, below
20. Engineering Construction: Highways and Railroads

The following price index is an implicit price deflator from D.B.S. derived from combining these three indexes, using as current weights the amount of expenditure in each year on each type of construction. It is continued into the past, to 1896, by using Buckley's construction price deflator, found in his book at page 128. Buckley's deflator is an implicit index and is therefore presumably currently weighted. It has been used as an indicator to carry back from 1926 the D.B.S. total non-residential implicit construction deflator, which is also currently weighted.

21. A Total Non-Residential Construction Implicit Price Deflator
    B Buckley's Implicit Cost of Construction Index, adjusted to 1949 = 100

The remaining indexes and deflators are of a miscellaneous character and are described in detail as they are reached.

22. Agricultural Machinery and Equipment

This index covers agricultural machinery and equipment made in Canada and is in the nature of a conventional price index derived by the actual pricing of various types of agricultural machinery. In this way it differs from other machinery and equipment price indexes, which are either derived directly from labour and material costs or from the combining together of indexes based on labour and material costs.

23. Non-Agricultural Machinery and Equipment

This is an implicit price deflator which covers all machinery and equipment other than farm machinery, regardless of whether it is Canadian-produced or imported. It is a combination, using current weights, of numbers 27 and 28 below.

24. Machinery and Equipment in Canada

This is the *National Accounts* implicit price deflator for all types of machinery and equipment. It will be found in Table 6.2 of Chapter 6 of this study.

25. Passenger Vehicles

This is a price index derived by combining the actual prices of standard types of passenger motor vehicles.

26. Commercial Vehicles

Though the raw material for this price index is a collection of average unit prices of various kinds of motor trucks, it is adjusted for discontinuities be-

tween years arising from changes in characteristics of vehicles and the changing distribution of the models of vehicle in use.

27. United States Machinery and Equipment in Canada
This price index is the over-all machinery and equipment index published by the United States Department of Commerce, adjusted by D.B.S. for exchange rates, import duties, sales and excise taxes, transportation and mark-up costs, to arrive at an index of prices paid by Canadian users.

28. Machinery and Equipment made in Canada
This index is a combination of prices of materials used and wage rates.

29. Iron and Its Products, 1890 to 1926
This is the Canadian wholesale price index for iron and its products, beginning in 1890, and given the 1926 level of our index (number 24) for Canadian machinery and equipment. It will be noticed that in industry 2602 central electric stations, a similar procedure has been adopted with respect to the wholesale price index for non-ferrous metals and their products, which was linked to the 1926 value of index number 19.

This completes the list of price indexes referred to in columns 5 and 6. It remains to explain the fact that in some machinery and equipment series two price indexes were used. For example, in deflating expenditures of central electric stations, two-thirds of the machinery and equipment expenditure was deflated by price index number 11, while one-third was deflated by price index number 23. In this case, this was a way of giving recognition to the fact that two kinds of assets were used by the industry, and that the price record of these kinds of assets differed. One portion covers American goods used in Canada, while the other portion covers goods thought to be produced in Canada, or of the same average content as all goods used in Canada. The ratios in which the two indexes are used were based upon the opinion of specialists who were asked to suggest how much of the equipment of various industries was of Canadian origin. In many cases it was found that the two indexes which were relevant showed such similar movement over the whole period 1926-55 that there was little to be gained by carrying out the deflation in two parts. In other industries (such as products of petroleum and coal), two indexes were used to cover the transition of the industry from coal processing to petroleum refining.

Columns 7 and 8: Service Life

Columns 7 and 8 contain the assumptions made about the average service life of structures and of machinery and equipment, respectively. As explained in the earlier parts of Chapter 6, we have acted on the assumption that the service life of each of the types of assets used by each industry remained constant over the entire period of cumulation. The sources of the

average lives used were as follows, in rough order of their usefulness and relevance to the Canadian situation:

1. U.S. Treasury Department, Internal Revenue Service: *Bulletin "F", Tables of Useful Lives of Depreciable Property,* tables reprinted without change from 1942 Revised Bulletin "F", I.R.S. Publication No. 173.

This publication consists of a remarkably detailed listing, for tax purposes, of the service life of various kinds of property. The detail is arranged so as to show not only the average useful life in years of each of the many kinds of assets used by one industry, but also the average useful life for the typical collection of assets owned by that industry. For example, trucks owned by the construction industry are given an average useful life of three, five or eight years, depending on their type; whereas trucks by the coffee, tea and spice industry are said to last an average of ten years. However, all the property (including vehicles) used by contractors working on highway construction is assumed to last on the average only six years, while the collection of machinery and equipment owned by concerns manufacturing coffee, tea and spices is said to average about 17 years.

The figures in *Bulletin "F",* revised in 1942, actually have particular reference to the middle 1930's, when they were collected. Although, therefore, they are not completely appropriate when used in connection with estimates for periods other than the late 1930's, they may be thought of as the outstanding collection of information on the subject.[18]

2. Canada, Department of National Revenue: *Income Tax Regulations; Schedule "B".*

Most of the present *Schedule "B"* was enacted by Order in Council in 1954, with subsequent revision. This schedule classes all property which may be owned by taxpayers into 17 classes; for each class a different method (usually a different rate) of depreciation deduction is prescribed. In earlier years, Canadian depreciation, like American depreciation, was calculated on a straight-line basis, and each class in effect gave the number of years over which the value or cost of an asset might be depreciated. Recently, however, Canadian depreciation has been calculated by the "diminishing balance" method, and the classes in *Schedule "B"* show the percentage of the remaining balance which may be deducted by the taxpayers each year. In the majority of cases, a simple arithmetic transformation was made from the straight-line to the diminishing-balance rate: the straight-line percentage rate was multiplied by two. Thus Class 8, which applies to machinery and equipment in general not specified in other classes, was formerly depreciated at 10% per year (for ten years). It is now depreciated at 20% per year of the balance reduced by the depreciation of previous years. If we take L as the assumed useful life of an item of property, the straight-line percentage rate is equal to 1/L x 100%. The diminishing balance rate is taken as 2/L x 100%.

[18]See the discussion of *Bulletin "F"* in E. L. Grant and P. T. Norton, *Depreciation,* New York, 1949.

The Canadian rates of depreciation, either on the old straight-line or the new diminishing-balance method are generally higher than those for comparable assets in the United States. Our observations have suggested that within a year the amount which a Canadian taxpayer is permitted to deduct on the old straight-line method is about 1.25 times the amount which his American opposite number would deduct on the same asset. Generalization, however, is very difficult. We have made less use of the Canadian regulations than of the American, because the Canadian detail is less fine than in the American *Bulletin "F"*.

Furthermore, the purpose of the Canadian *Schedule "B"* is rather an attempt to provide a statutory rate at which taxpayers are allower to recover their capital cost. It is nowhere stated that the implied capital cost recovery period is intended to be the exact equivalent of the average service life of property.

3. United Kingdom: Board of Inland Revenue: *Income Tax, Wear and Tear Allowance for Machinery or Plant: List of Percentage Rates.*

The rates in this publication have in some cases been in force in the United Kingdom for many years, while others have been allowed comparatively recently. There appears to be an attempt to bring the percentage rates into agreement with the anticipated working life of the property being depreciated. However, the rates also reflect official intention to give relief or incentive to particular industries.

In addition to the percentage rates published in this pamphlet, there is also a series of rates permitted by the Board of Inland Revenue arising out of decisions in particular income tax cases. These decisions can most conveniently be obtained in commercially published taxpayers' manuals.

We have also had access to a special study made in 1949 of the value of domestic disappearance and of average life expectancy of various types of machinery and equipment in Canada. This study, made by the Department of Trade and Commerce, drew upon some 14 government and private tax and engineering publications, as well as the results of some 40 personal interviews with the appropriate executives of Canadian business corporations.

The figures shown in columns 7 and 8 are in some ways a consensus of the estimates provided by the above sources, influenced by decisions made by Philip Redfern in his study "Net Investment in Fixed Assets in the United Kingdom, 1938-1953", published in the *Journal of the Royal Statistical Society,* Series A, 1955, p. 141, and by Raymond W. Goldsmith, in *A Study of Saving in the United States,* 1956, Volume III, Table W-7, col. 4.

In a few situations we have been forced to take recognition of the changing average service life of assets of particular industries. Outstanding among these is 5510, electric railways, where the machinery and equipment

was assumed to have an average life of 20 years in 1926, but to have fallen to about 11 years in 1955. This particular change was due to the declining percentage of relatively durable streetcars in the collection of assets of such corporations.

In the case of ocean shipping, the stock was calculated directly from the tonnage to be found in annual volumns of Lloyds' Register. By comparing these tonnages at a fixed valuation per ton with the investment figures to be found in *PPI*, we calculated that the average life of Canadian shipping over the past 30 years had been of the order of 30 years.

These average service lives are relatively satisfactory, conceptually speaking, when they are applied to assets such as motor vehicles, processing machines and buildings. However, it is obvious that when they are applied to investment in railroads or highways, there is need for a very close correspondence between the concept of investment used, particularly the distinction between repair and replacement, and the service life applied to that kind of investment. The concept of investment for railways is discussed in *PPI* pages 212 and 225, and also at various places in Buckley. New investment in roads is discussed in *PPI* at page 232. The authors of *PPI* state (p. 213) that the resurfacing or rebuilding of any extended length of street or highway is considered to be a major improvement, and that major improvements are considered to be new construction for the purpose of the investment tables.

Any person who has consulted the discussion of Canadian railway accounting in the *Royal Commission on Transportation,* 1950, or other similar sources, knows of the considerable variation of practice between the two major railways of Canada and at various periods in Canadian railway history. We have gladly accepted the adjustment in *PPI* of the accounting statements made by the two railways. As far as we can discover, *PPI* shows as new investment only expenditures which an observer would call major improvements of existing assets or relatively large-scale replacement of existing assets.

Perhaps the best way to explain our understanding of these figures as they now appear is to say that we assume that, on the average, such expenditures as are shown as new construction in *PPI* by steam railways would, if maintained in reasonable condition, last an average of 50 years before needing replacement, while new investment in machinery and equipment would, on the average, last 33 years if maintained in reasonable condition before needing replacement.

Note: In the table the letter *T* stands for Table. The word *Consolidation* at the head of each sector applies to the process of consolidating the estimates for the various industries within that sector, as well as carrying out the additional computations shown.

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1000	AGRICULTURE	1896-1925: Deflated *PPI* figure for 1926, carried back to 1896 on index which gives equal weight to farm residential construction (Buckley, p.22) and farm machinery expenditure (Buckley, p.132). See note on farm buildings, Buckley, p.121 1926-49: *PPI*, T 19 1950-55: *Outlook*, T 1 (adj. for fishing, see 2091)	1896-1925: *PPI* figure for 1926 carried back using Buckley, T "D" p. 132 (Class 1, line 5) 1926-49: *PPI*, T 19 1949-55: *Outlook*, T 1	1896-1925: 18 1926-55: 18	1896-1925: 22 1926-55: 22	40	13
2000	RESOURCE INDUSTRIES						
2080	Forestry	1908-20: 1921 carried back on index of total lumber production 1921-25: Method described in *PPI*, p.220 carried back to 1921: data from *Forest and Forest Products Statistics*, Bulletin 106, T 6 1926-49: *PPI*, T 21 1950-55: *Outlook*, T 1	1921-25: As for construction 1926-49: *PPI*, T 21 1950-55: *Outlook*, T 1	1908-25: 21B linked to 20 1926-55: 20	1921-25: 29 linked to following index 1926-55: 3, changing from 11%, 1926 to 40%, 1955; and remainder: 28	21	9
2091	Fishing	All construction expenditure allocated to machinery and equipment	1926-49: *PPI*, T 20 1950-55: E.S., T. & C.	—	1926-55: 23	—	6
2100	Mining, quarrying and oil wells	1898-1925: Deflated *PPI* figure for 1926 carried back on index of domestic supply of mining machinery 1926-49: *PPI*, T 22 1950-55: *Outlook*, T 1	1898-1925: As for construction 1926-49: *PPI*, T 22 1950-55: *Outlook*, T 1	1898-1925: 21B 1926-55: 19	1898-1925: 29 1926-39: 23 1940-55: 23 changing from 99% to 63%; remainder 5	25	16

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
		Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2602	Central electric stations..........	1888-1925: Deflated *PPI* figure for 1926 carried back to 1888 using machinery and equipment expenditure in constant dollars as index. See also Department of the Interior: *Water Powers of Canada*, 1927, p.16; and *Annual Report* 1928-29, p.39 1926-49: *PPI*, T 47 1950-55: *Outlook*, T 5 & 3	1896-1920: 1921 carried back on index of electrical imports 1921-25: 1926 carried back on index of domestic supply of electrical machinery 1926-49: *PPI*, T 47 1950-55: *Outlook*, T 5 & 3	1890-1920: 19 linked to "Non-ferrous metals and their products" 1926-55: 19	1926-55: ⅔ 11 ⅓ 23	55	30
3000	PRIMARY MANUFACTURING CONSOLIDATION	1896-1925: Deflated 1926 total for following four primary manufacturing industries carried back to 1896 on index from 8003: Food & beverages 3200, non-ferrous metal products 3345, non-metallic mineral products 3361, chemical products 3380	1926-55: Capital expenditures out of operating revenues for all manufacturing were allocated to primary manufacturing in ratio of primary manufacturing machinery and equipment expenditure to secondary manufacturing machinery and equipment. Sources: *PPI*, T 39 (adjusted 1926-32), *Outlook*, T 4 & 2, and E.S., T. & C.		23	50	16
3200	Food and beverages (primary)	1926-49: *PPI*, T 27 Primary: 36.15% Secondary: 63.84% (Average ratio over 1946-55 from E.S., T & C.) 1950-55: *Outlook*, T 4 & 2 & E.S., T. & C.	1926-49: *PPI*, T 27 (1926-32 adjusted) Primary: 47.0%; Secondary: 53.0% (Average ratio over 1946-55 from E.S., T .& C.) 1950-55: *Outlook*, T 4 & 2 & E.S., T. & C.	18	7	see 3000	18

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3281	Wood and its products (primary)	1913-25: Construction taken as 2.29 times M & E (ratio over 1926-30).	1913-25: 1926 figure carried back to 1913 on index of domestic supply of saw and planing mill machinery.	21B	29	35	18
	See also 4286	1926-49: *PPI*, T 31 Primary: 60.6%; Secondary: 39.4% (Average ratio over 1948-55 from E.S., T & C.)	1926-49: *PPI*, T 31 Primary: 75%; Secondary: 25% (Average ratio over 1948-55 from E.S., T. & C.)	18	60%-7 40%-23		
		1950-55: *Outlook*, T 4 & 2 & E.S., T. & C.	1950-55: *Outlook*, T 4 & 2 & E.S., T. & C.				
3294	Pulp and paper (primary)	1885-1945: 85% of total pulp & paper construction. (85% ratio from E.S., T. & C. data for 1946-1955.)	1885-1945: 85% of total pulp & paper. (85% ratio from E.S., T. & C. data from 1946-55.)	21B	29	50	21
		1946-55: E.S., T. & C.	1946-55: E.S., T. & C.	19	20%-7 80%-28		
		See also data for 1871, 1881, 1891 on pulp mills from Census & *C.Y.B.*, 1907.					
3345	Non-ferrous metals and products plus electrical apparatus and supplies (primary)	1926-46: *PPI*, T 36	1926-46: *PPI*, T 36	21	7	see 3000	Primary 18
		Primary: 58.3%; Secondary: 41.7%.	Primary: 47.1%; Secondary: 52.9%.				
	See also 4341	(Average ratio over 1947-55 from E.S., T. & C.)	(Average ratio over 1947-55 from E.S., T. & C.)				
		1947-55: *Outlook*, T 4 & 2 & E.S., T. & C.	1947-55: *Outlook*, T 4 & 2: E.S., T. & C.				

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3361	Non-metallic minerals & products plus products of petroleum and coal (primary)	1926-45: *PPI*, T 37 Primary: 9.1%; Secondary: 90.9% (Average ratio over 1946-55 from E.S., T. & C.)	1926-45: *PPI*, T 37 Primary: 19.9%; Secondary: 80.1% (Average ratio over 1946-55 from E.S., T. & C.)	19	23	see 3000	Primary 23
	See also 4362	1950-55: *Outlook*, T 4 & 2 & E.S., T. & C.)	1950-55: *Outlook*, T 4 & 2, E.S., T. & C.				
3380	Chemical products industry (primary) See also 4381	1926-46: *PPI*, T 38 Primary: 53.9%; Secondary: 46.1% (Average ratio over 1946-55 from E.S., T. & C.)	1926-46: *PPI*, T 38 Primary: 58.5%; Secondary: 41.5% (Average ratio over 1946-55 from E.S., T. & C.)	19	27	see 3000	Primary 15
		1946-55: *Outlook*, T 4 and 2; E.S., T. & C. (Note: data since 1946 differ from *PPI*.)	1946-55: *Outlook*, T 4 and 2; E.S., T. & C. (Note: data since 1946 differ from *PPI*.)				
4000	SECONDARY MANUFACTURING CONSOLIDATION	1896-1925: Total of 1926 deflated figures for following industries carried back to 1896 on construction index from 8003 below: Food & beverages; Rubber, leather & tobacco; Textiles; Clothing; Printing & publishing; Iron & steel; Transportation equipment; Non-metallic (including petroleum & coal); Chemicals; Miscellaneous manufacturing	Capital items charged to operating expenses from E.S., T. & C. 1926-32: adjusted figures 1926-49: *PPI*, T 39, adjusted to exclude miscellaneous manufacturing industries, E.S., T. & C. Yearly ratios: Primary consolidation. Secondary consolidation See also 3000		23	50	16

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years: Construction	Service life (years: Mach. and equip
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4218	Food & beverages...	See 3200	See 3200	18	7	see 4000	14
4230	Rubber, leather and tobacco..........	1926-49: *PPI*, T 28 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 28 1950-55: *Outlook*, T 4 and 2	21-A	7	see 4000	16
4251	Textiles...........	1926-49: *PPI*, T 29 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 29 1950-55: *Outlook*, T 4 and 2	18	7	see 4000	21
4270	Clothing..........	1926-49: *PPI*, T 30 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 30 1950-55: *Outlook*, T 4 and 2	18	7	see 4000	16
4286	Wood & its products	See 3281	See 3281	18	60%-7 40%-23	35	18
4292	Pulp & paper.......	See 3294	See 3294	19	20%-7 80%-28	50	21
4301	Printing, publishing & allied industries...	1926-49: *PPI*, T 33 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 33 1950-55: *Outlook*, T 4 and 2	18	7	see 4000	17
4311	Iron & steel products	1926-49: *PPI*, T 34 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 34 1950-55: *Outlook*, T 4 and 2	21	50%-6 50%-23	see 4000	16
	Sub-groups:	1926-45:	1926-45:				
		I Agric. implements mfg. 6.2%	I Agric. implements mfg. 5.9%				22
		II Machine industry (incl. machine shops) 19.5%	II Machine industry (incl. machine shops) 16.4%				24
		III Primary iron & steel 36.8%	III Primary iron & steel 40.7%				15
		IV All other 37.5% (ratios from E.S., T. & C. data for 1946-55).	IV All other 37.0% (ratios from E.S., T. & C. data for 1946-55).				22
		1946-55: E.S., T. & C. data See also "Blast Furnaces", *C.Y.B.* 1900-10.	1946-55: E.S., T. & C. data				

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4330	Transportation equipment industry	1926-49: *PPI*, T 35 1950-55: *Outlook*, T 4 and 2	1926-49: *PPI*, T 35 1950-55: *Outlook*, T 4 and 2	18	6	see 4000	see sub-groups
	Sub-groups:	1926-46: I M/V & parts 64.5% II R.R. rolling stock 13.9% III Shipbuilding 3.8% IV Aircraft & all other 17.9% (ratios from E.S., T. & C. data 1946-55)	1926-46: I M/V & parts 72.1% II R.R. rolling stock 12.6% III Shipbuilding 5.5% IV Aircraft & all other 9.9% (ratios from E.S., T. & C. data 1946-55)				11 25 23 15
		1946-55: E.S., T. & C. data.	1946-55: E.S., T. & C. data.				
4341	Non-ferrous metal products & electrical equipment....	See 3345	See 3345	21-A 21	7 7	see 4000 see 4000	20
4362	Non-metallic minerals & products plus products of petroleum & coal.......	See 3361	See 3361	19	23	see 4000	18
4381	Chemical products industry..........	See 3380	See 3380	19	27	see 4000	20
4391	Miscellaneous manufacturing industries	1926-32: *PPI*, T 39 (adjusted) 1933-49: *PPI*, T 39 1950-55: *Outlook*, T 4 and 2	1926-55: (Capital expenditures out of operating revenues for all manufacturing industries extracted from *PPI*, T 39 with assistance from E.S., T. &. C.)	18	23 23	see 4000 see 4000	15 16

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4400	TOTAL MANUFACTURING	1876-1896: Figure for 1896 in current dollars carried back to 1876 quinquennially on rough indicator of G.N.E., then converted to $1949 using wholesale price index 1896-1925: Total of deflated primary plus secondary investment carried back to 1896 on construction index from 8003 below 1926-55: Total of deflated primary and secondary investment: 3000-4391	1896-1925: Buckley, Table "C". Total of Classes 2, 3, 4 and 8, 9, 10, 11 used as index to carry back *PPI* average for 1926-30. (See discussion of this procedure in a forthcoming NBER paper by Buckley: the discrepancy he notes between *PICF*, *PPI* and his own estimates is largely accounted for by the correction of Food and beverage industry machinery & equipment estimates for 1926-32, mentioned in this study.) 1926-1955: This series, deflated, was used to carry back the total deflated investment in manufacturing, 3000-4391; i.e. total primary + total secondary	General wholesale price index	29	40 (Derived by trial cumulation, to achieve agreement in size of gross stock with total primary and secondary gross stock)	18 (Derived by trial cumulation, to achieve agreement in size of gross stock with total primary and secondary gross stock)
5000	TRANSPORT, STORAGE & COMMUNICATION CONSOLIDATION	1896-1955: Current dollar construction figures for the following industries have been consolidated and the deflated 1926 figure carried back to 1896 on index from 8003 below: Air transport, 5501 Motor carriers, 5514 Water transport, 5516 Grain elevators and warehousing, 5524	1926-55: Capital expenditures out of operating revenues for Transport, storage & communication plus Trade, services and construction were obtained from E.S., T. & C. 50% of the annual amount was assumed to apply to Transport, storage and communication.	21-A	23	50	16

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
		Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5501	Air transport.......	1926-44: E.S., T. & C. 1945-49: *PPI*, T 65 1950-55: *Outlook*, T 3 and 5 (adjusted for oil pipelines and warehousing) 1945-55: *C.Y.B*: Annual increase value of air transport improvements and buildings.	1926-44: E.S., T. & C. 1945-55: Index of annual increase in *C.Y.B.* table: aircraft engines and parts.	See 5000	14	see 5000	9
5508	Steam railways & telegraphs........	1896-1925: *PPI* figures for 1926-30 carried back to 1896 on Buckley's R.R. net investment (T "J") plus replacement (Col. 2 T "J") adjusted for repairs by ratio/replacement implicit in Table on p. 118.	1896-1926: Buckley, T "J", linked to *PPI* 1926, (Assuming telegraph is a constant % of R.R. expenditure)	Buckley, T "A"	29	50	28
		1926-49: *PPI*, T 52 1949-55: *Outlook*, T 5 and 3	1926-49: *PPI*, T 52 1949-55: *Outlook*, T 5 and 3	20	⅔—16 ⅓—23		
5510	Electric railways....	1926-49: *PPI*, T 55 1950-55: *Outlook*, T 5 and 3 Track mileage data: *C.Y.B.* 1937 p. 662; 1938 p. 667; 1940 p. 660; 1951 p. 734; 1955 p. 853; *D.B.S. Electric Railways*, 1953, p. 9	1926-49: *PPI*, T 55 1950-55: *Outlook*, T 5 and 3	1926: $130,000/mile (various sources incl. annual reports, Toronto Transport Commission)	16	40 1926 gross stock estimated @ $130,000/mile. Discards from annual decline of mileage at $130,000/mile.	1926-55: 20 to 11 1926-20 to 1955-11 (Changing because of changing proportions of buses, trolley buses and trams)

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

		Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
Number	Industry	Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5514	Motor carriers......	1926-44: E.S., T. & C. 1945-49: *PPI*, T 65 1950-55: *Outlook*, T 3 and 5	1926-44: E.S., T. & C. 1945-49: *PPI*, T 65 1950-55: *Outlook*, T 3 and 5	See 5000	26	see 5000	7
5516	Water transport (shipping)........	1926-49: E.S., T. & C. 1950-55: *Outlook*, T 3 and 5	1926-49: E.S., T. & C. 1950-55: *Outlook*, T 3 and 5 Also: Annual Reports, Can. Maritime Commission, esp. 1949. *Lloyd's Register*, various years.	See 5000	$300/d.w.t. (from "Playfair" index adjusted for exchange rate ship types, etc.)	see 5000	Stock calculated from *Lloyd's Register* (100 tons and over valued at $300/ d.w.t. (implied life: 30 years)
5519	Oil pipelines........	1926-44: E.S., T. & C. 1945-49: *PPI*, T 65 1950-55: *Outlook*, T 3 and 5 (adjusted for air transport & warehousing).	1926-44: E.S., T. & C. 1945-49: *PPI*, T 65 1950-55: *Outlook*, T 3 and 5	19	23	40	33
5524	Storage: Warehousing and grain elevators....	Grain Elevators: 1926-49: E.S., T. & C. 1950-55: *Outlook*, T 3 and 5 Warehousing (all years): E.S., T. & C.	1926-49: E.S., T. & C. 1950-55: *Outlook*, T 3 and 5 1926-55: E.S., T. & C.	See 5000	23	see 5000	16

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
		Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5547	Telephones and broadcasting......	1895-1926: *PPI* 1926 figure carried back on index of following series: (1912-26: Annual increase of mileage of wire and annual increase of telephones installed, equally weighted. 1895-1912: Annual increase of number of telephones installed. Graphic interpolation for missing years). Data: *C.Y.B.* 1938 and D.B.S. files. 1926-49: E.S., T. & C. (broadcasting). 1926-49: *PPI*, T 58 (telephone) 1950-55: *Outlook*, T 5 and 3.	1920-26: *PPI* 1926 deflated figure carried back to 1920 on index of domestic supply of telephones, 1926-49: E.S., T. & C. (broadcasting). 1926-49: *PPI*, T 58 (telephone) 1950-55: *Outlook*, T 5 and 3.	19	11	30	25
6000	TRADE, SERVICES AND CONSTRUCTION CONSOLIDATION		1926-55: Capital expenditures out of operating revenues for Transport, storage and communication *and* for Trades, services and construction were obtained from E.S., T. & C. 50% of the annual amount was assumed to apply to the public utility industries in Trades, services and construction. (See also 5000, 6700)		23	50	16
6404	Construction industry..........	1896-1925: *PPI* deflated figure for 1926 carried back to 1896 on index from 8003 below.	1926-49: *PPI*, T 23 1950-55: *Outlook*, T 1	21	33%: 4 66%: 23	25	9

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
6608	Waterworks........	1896-1925: Deflated *PPI* figure for 1926 carried back to 1896 on index of urban building activity (Buckley, pp. 140-141) and gross municipal investment (Buckley, p. 139). (Index of domestic supply of pipe also used.) 1926-49: *PPI*, T 61 1950-55: *Outlook*, T 5 and 3	All new machinery & equipment expenditure re-allocated to "Construction", column 3.	21	n/a	50	n/a
6700	Trade—wholesale and retail........	1896-1925: Deflated *PPI* figure for 1926 carried back to 1896 on index from 8003 below. 1926-49: *PPI*, T 67 1950-55: *Outlook*, T 6 and 4	1926-49: *PPI*, T 67 (1926-32 adjusted). (Also includes wholesale and retail capital expenditures out of operating revenues (obtained from E.S., T. & C.). 1950-55: *Outlook*, T 6 and 4	18	66% : 9 33% : 23 23	50	16
6800	Finance, insurance and real estate....	1896-1925: Deflated *PPI* figure for 1926 carried back to 1896 on index from 8003 below. 1926-49: *PPI*, T 68 1950-55: *Outlook*, T 4 and 6	1926-49: *PPI*, T 68 (1926-32 adjusted). 1950-55: *Outlook*, T 4 and 6	18	66% : 9 33% : 23	50	15
	Commercial services (business, recreational, personal)	1896-1926: Deflated *PPI* figure for 1926 carried back to 1896 on index from 8003 below 1926-49: *PPI*, T 69 1950-55: *Outlook*, T 1	1926-49: *PPI*, T 69 1950-55: *Outlook*, T 1	18	10	50	13

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7000	GOVERNMENT HOUSING AND COMMUNITY SERVICES ("Social Capital")						
7001	Roads.............	1896-1926: Federal and Provincial Federal expenditures assumed negligible. Provincial expenditures 1901-26: Buckley T "K" p. 137, Col. 1 carried back to 1896 Buckley T A.* (2) p. 128. Municipal Benchmarks 1913 & 1921 calculated on basis assuming new construction expenditures equalled 49.4% of current expenditures, as given in the *Report of the Royal Commission on Dominion-Provincial Relations* (1940). Benchmark 1904 based on municipal expenditures on transportation as given in the Citizens' Research Institute of Canada — *Special Report on Taxation & Public Expenditure* — (1937) — Appendix Chart E. Intervening years via Buckley T "A".		1896-1925: 21 B linked to 20		23	

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7001	Roads (concluded)..	*Note: Table 9 (which includes new and repair together) as a basis for interpolation was adjusted by constructing a yearly series on new construction only, using Table B which gives 5-year totals for new and repair expenditures separately. This series on new construction only is denoted in these notes as Table A*.					
		1926-55: All governments		1926-1955: 20			
		PICF Section 4 T 17a & 18a, and *Comparative Statistics of Public Finance* (1955). Intervening years to 1937 interpolated on basis of total new engineering construction by federal and provincial government departments. Thereafter D.B.S. *Highway Statistics* used as interpolator.					
		1956: *Construction in Canada 1954-56* T 17					

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

		Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
Number	Industry	Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7002	Buildings..........	1896-1926: Basis for estimation was: *Buildings and other engineering = Total government departments — Roads.* Total government departments — 1901-26: Federal and provincial from Buckley T "L" p. 138. Municipal from Buckley T "M" p. 139, col. 3 in which 5-year totals were reduced by 30% to make table coincide with PPI & distributed on a yearly basis using T A* as a guide. Total government departments — 1896-1900 by extending figures for 1901-26 back using Buckley T. A as index.		1896-1925: 21 B linked to 18		50	
		1926-1949: *PPI* — Federal T 88, Provincial T 96, Municipal T 114		1926-55: 18			
		1950-1956: *Outlook* T 1 for total new construction by government departments, divided between building and engineering on basis of *Construction in Canada* (T 15, 16 and 17).					

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7003	Other engineering...	*Other engineering = Total engineering — Roads* Total engineering: 1896-1925: See 7002 1926-49: Other engineering plus government expenditures on Resources development — Federal *PPI*, T 88 col. 3 p. 187 Provincial *PPI* T 93 col. 3 p. 191 1950-55: See 7002		19		40	
7004	Machinery and equipment........		1896-1925: 15.0% of New construction by government departments (Total of 7001 — 7003) 1926-49: *PPI*,T 9 p. 149 1950-56: *Outlook*, T 1		29		15
7809	Housing...........	1896-1925: Buckley — T "N" p. 139, 5-year totals distributed to annual basis using T A* as a guide 1926-49: *PPI*, T 70 p. 180 1950-55: *Outlook*		1896-25: 21 B 1926-55: National Accts. Residential IPD		50	

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

		Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
Number	Industry	Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
7900	Institutions:........			1896-1925: 21 B linked to 18 1926-1955: 18		50	
7901	(a) Schools.........	1896-1925: 3.9% of new construction Buckley T "A" 2 p. 128 1926-49: *PPI*, T 77 & T 78 1950-55: *Outlook*, T 5 (Ratio is 1926-30 average)	1896-1925: 11.9% of new construction expenditures on schools. 1926-55: *PPI*, T 77 & T 78; *Outlook*, *T* 5 (Ratio is 1926-30 average)				
7904	(b) Churches.......	1896-1925: 1.28% of computed new construction Buckley T A.* 2 page 128 1926-49: *PPI*, T 76 page 183 1950-55: *Outlook* T 5 (Ratio is 1926-30 average)	1896-1925: 10.5% of new construction of churches 1926-55: *PPI*, T 76 *Outlook* T 5 (Ratio is 1926-30 average)				
7903	(c) Hospitals.......	1896-1925: 1.17% of new construction Buckley T A.* 1926-49: *PPI*, T 79 p. 184 1950-55: *Outlook*, T 5 (Ratio is 1926-30 average)	1896-1926: 19.5% of new construction of hospitals 1926-55: *PPI*, T 79, *Outlook* T 5 (Ratio is 1926-30 average)				

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Cont'd.)

Number	Industry	Source of expenditure data at original cost: Construction	Source of expenditure data at original cost: Machinery and equipment	Price indexes (number): Construction	Price indexes (number): Machinery and equipment	Service life (years): Construction	Service life (years): Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8002	"INDUSTRY" DIRECT CUMULATION	1871-96: Rough quinquennial estimate of G.N.E. deflated by wholesale price index used as index to carry back constant dollar average 1896-1906	1896-1925: Buckley Table "C" ("producer's prices") used to distribute annually quinquennial data at market prices. This series was used as an index to carry back 1926 figure.		29	40 Derived by trial cumulation to achieve agreement in size of gross stock with total 8000 gross stock	15 Derived by trial cumulation to achieve agreement in size of gross stock with total 8000 gross stock
		1896-1925: Buckley total construction T "H" less Housing and Government (T "L" and "N") used as index to carry back figure for 1926, in constant dollars	1926-50: *PPI*, T 13 less Institutions T 73 less Government departments T 9 corrected for error 1926-32	21 B	24		
		1926-55: Total investment by industry 8000.	1951-55: Business enterprise plus Government-owned enterprise *Outlook*, T 6				
		1871-1955: Also cumulated at original cost	1896-1955: Also cumulated at original cost.				
8003	"RESIDUAL CONSTRUCTION SERIES"	(a) Basic series: 1900-26: Buckley's quinquennial new construction (T "H") 1896-1900: carried back on (Col. 1 T "A"). Entire series distributed annually on Col. 1 T "A".		21 B			

FIXED CAPITAL ESTIMATES — SOURCES AND METHODS (Concluded)

Number	Industry	Source of expenditure data at original cost		Price indexes (number)		Service life (years)	
		Construction	Machinery and equipment	Construction	Machinery and equipment	Construction	Mach. and equip.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8003	"RESIDUAL CONSTRUCTION" (concluded)	(b) Deductions:					
		(i) Railroad construction See 5508					
		(ii) All government construction 1896-1900 estimated by carrying back 1901 figure on "Total construction" (T "A"). 1901-26 (T "M") interpolated annually on (Col. 6 T "L")					
		(iii) Housing: Buckley (Col. 4 T "N") distributed annually on index (Col. 6 T "O")					
		(iv) Other industries: See notes on 1000; 2080; 2100; 2602; 3284; 3291; 5547; 6608 which were all carried back independently.					

APPENDICES — CHAPTER 7

Chapter 7, Appendix A

SOME TECHNICAL PROBLEMS OF RECONCILING FORECASTS

IN THIS appendix we wish to refer to certain technical problems involved in testing and achieving consistency of the forecasts. We do not aim, however, at a systematic and constructive exposition of the problems and methods of reconciling forecasts. Rather we wish to explain why we felt we had to limit ourselves to methods that were, on the whole, informal and why, in the process, we had largely to exclude from our detailed consideration some variables that we should have preferred to include. In particular we wish to explain why use was not made of the modern techniques known as input-output analysis and why relative prices do not appear prominently in our discussions of assumptions, methods and results.

The problems of reconciling forecasts are very much clarified if the historical data are cast within a framework of consistently defined concepts and if the forecasts can be so cast. We were very much aided in our work and in discussions among the individual forecasters by the framework provided by the interlocking National Accounts. The concepts involved enabled us to speak of many of our problems in a common language, and many of the variables we sought to forecast could be related to each other in this framework. We were not so fortunate however when we came to questions of output and employment and capital of industries and the relations of those to each other and to the National Accounts' categories. As we have explained we were forced to build up, as best we could, a record of employment by industries, output by industries (the record of national income by industries was not considered satisfactory for our purposes for the reasons given in Chapter 5) and the stock of capital by industries. Even at that however, we still lacked a record of the inter-industry exchange of output and the distribution of the items making up G.N.E. by industry of origin. When we had nearly completed our work, D.B.S. published a study of *The Inter-Industry Flow of Goods and Services, Canada, 1949* (Reference Paper No. 72) which we were privileged to see in advance of its publication. But since it pertains only to one year, 1949, we were not able to make other use of it than is described in Chapter 5. Data on financial transactions also were

not integrated within a common framework and though strenuous efforts were made to extend (for a few postwar years) the National Accounts to a system of national transactions accounts that includes financial flows among sectors of the economy as well as flows of real goods and services, the task was so tremendous that the results were not available in time for our discussions on the reconciliation of forecasts; we expect that they will be used in the study *Financing of Economic Activity in Canada.*

One of the most important consistency checks that we wished to make involved relating the forecasts of G.N.E. and its components to the forecasts of the outputs of individual industries and the use of labour and capital in these industries. These relations are the classic ones in the field of input-output analysis tilled so assiduously in recent years by Professor W. W. Leontief and his associates at Harvard. The basic framework used in input-output analysis is a table of the inter-industry flows of goods and services which essentially is the record for a given year of the sources of the inputs of each industry and the destinations of the outputs with such definitions and frills as permit: (a) the input of each industry to equal its output, input and output being appropriately valued; (b) inputs of each industry of the primary factors of production to equal that industry's contribution to G.D.P.; and (c) imports plus the outputs of each industry going directly to final users (rather than back to industry for use in current production) to equal G.D.P. plus total imports. This is the construction of the 1949 table prepared by D.B.S. for the publication referred to above. Without going, in any detail, into the character of input-output analysis let us explain briefly why we felt we could not make use of its techniques in our work.

In its barest essentials the technique of input-output analysis enables one to calculate from the G.N.E., the G.D.P. of each industry and the use of labour in each industry, if one knows (a) the distribution of each class of G.N.E. by industry of origin and (b) for each industry, the ratios of its inputs of the products of each industry, of imports, and of labour, to its output. It is perhaps also possible, by the use of capital-output ratios, to calculate the capital stock required in each industry.

The first problem in using the technique for the purpose we have described is to convert forecasts of G.N.E. categories into a distribution of industrial contributions to G.N.E.; that is, to state the proportion of consumer expenditure, government expenditure on goods and services, investment expenditure (including inventories) and expenditures of foreign buyers that will be devoted to the goods and services supplied by each industry. This problem itself was, for us, well-nigh insurmountable. Such a distribution was available for only one year, 1949 (and became available late in our work). Cases in which specific commodities or services are supplied by specific industries present no particular problems (except that one has to

work with classifications fine enough to isolate them) but in general it is difficult to move from commodity classifications to industrial classifications.

The second great difficulty concerns the assumptions to be made about the input-output coefficients. The simplest assumption to make and one that has been made in some forecasting work is that these coefficients are constant, so that if an industry's output increases by a given percentage, each of its inputs will increase by the same percentage. To state the matter so bluntly is to make it obvious that the chances of constancy of the coefficients in actual experience are low indeed. Moreover, the presumption must be that the longer the period over which constancy is projected, the greater is the likelihood that the coefficients will not be constant. There are many reasons for this. Each industry produces a variety of products, and in general consumes more than one kind of product from any particular supplying industry. Therefore changes in the composition of output of any industry will affect its coefficients and the coefficients of industries that sell to it and that buy from it. Over a fairly long period, 25 or 30 years, changes in "product mix" may be considerable; indeed some new products (or even industries) may emerge while others may disappear entirely. Quite apart from this consideration, one must anticipate that changing technology and changing prices will each in their own ways affect the combinations of inputs used in an industry per unit of output. In addition to this, many input-output tables, including the Canadian for 1949, are so constructed that input-output coefficients for any industry are affected by changes in import duties, excise taxes and transportation changes and trade margins on the goods it consumes. Finally we may also mention that the input-output table for any year is a snapshot record of an economy in process and reflects the fact that an industry at any moment buys goods produced earlier in anticipation of selling goods it will produce later. Changes in the rate of growth of the economy as a whole as well as of its component industries and sectors would therefore be reflected in modifications of the input-output coefficients. This problem may be less important for long-run forecasting than for short-run forecasting.

The answer to the above objections to the assumptions that coefficients will remain constant at the values that may be calculated from the most recent available input-output table is obviously in principle to forecast consistently the changes in each. The difficulties of this approach are quickly summed up in the reminder that the number of coefficients involved is substantially in excess of the square of the number of industries considered; if we work with ten industries, we must work with some 120 coefficients.[1]

A third problem concerns the degree of aggregation of industries to choose for the analysis. The lower the number of industries treated, the lower are the computational and other costs but of course the more general

[1]That is, if we wish to calculate for a given G.N.E., the distribution of output by industries and the use by each industry of labour and imports (assuming that there is only one class of each).

must be the conclusions drawn. The degree of aggregation has unpredictable effects on the stability of coefficients. The higher the degree of aggregation the greater are the chances of changes in the product mix and there is no assurance that the effects of these will be in some degree offsetting. On the other hand, the lower the degree of aggregation, the greater is the likelihood that substitutions among inputs in response to changing technology or prices will be reflected in unstable coefficients.

Finally, we may mention that at best statistical expertise can only supply an input-output table from data available in the records, in which some inputs of each industry cannot be traced to a source and some outputs cannot be allocated to a user. This is messy and creates technical difficulties.

These then are the reasons that led us to decide against using the formal techniques of input-output analysis in checking our forecasts of expenditure by expenditure classes against our forecasts of output and employment by industries. To have used the technique would have involved the making of a quite staggering array of detailed assumptions beyond those we had already made, and we should not have known after making the checks whether apparent inconsistencies were to be attributed to the assumptions underlying the basic forecasts or to the assumptions made in the consistency check. We were fortified in our decision by the results of the use of input-output analysis by others in predicting both forward and backward which have been summarized by one qualified authority as follows: "In sum, the direct statistical testing performed thus far leaves the critical issue in doubt . . . [but] after all the model is not designed to assist in predictions over a period of a decade or so".[2]

The commission staff had to be content with less formal checks. We built up the forecast of total G.N.E. by forecasting the output of three sectors of the economy using the labour force that we thought would be available, under certain assumptions as to productivity. We then compared

[2]Robert Dorfman, "The Nature and Significance of Input-Output", *Review of Economics and Statistics*, Vol. XXXVI, 1954, p. 131.

Professor Milton Friedman, in commenting on the paper by Carl F. Christ ("A Review of Input-Output Analysis" in *Input-Output Analysis, and Appraisal, Studies in Income and Wealth*, Vol. 18, National Bureau of Economic Research, New York, 1955) remarked on the empirical testing of input-output analysis that had been accomplished to that date (October, 1952) in the following vein: "The proof of this pudding is in the eating, and we still have very little to eat. And what we have is not, I fear, very digestible . . . Christ has summarized the various tests that have been made on the basis of earlier input-output tables. These tests are almost wholly negative, they reveal no systematic tendency for input-output analysis to yield better predictions than other vastly simpler methods. Perhaps further evidence will reverse these results; until it does, input-output analysis must be regarded as an hypothesis that has been contradicted by the data so far available" (pp. 172-173).

We may however refer also to the results of A. A. Adams and I. G. Stewart, very recently reported in "Input-output Analysis: an Application", *Economic Journal*, Vol. LXVI, September, 1956, pp. 442-454. These authors used the input-output coefficients derived from a table pertaining to the United Kingdom in 1935 and estimates of final demand by industries for 1924, 1930, 1933 and 1934 to produce estimates of outputs of individual industries which were then compared with estimates of the industries' outputs derived from the Census of Production for these latter years. The (algebraic) sum of the deviations of the outputs forecast by the input-output analysis from the outputs computed from the Census of Production deviated by approximately 5% from total output of industries as measured by the Census of Production for each of the two years 1924 and 1930. But the range of the deviations for particular industries was from virtually zero to 35%, and there were some large deviations, of the order of 20% for some relatively large industries. Moreover "for most industries these percentage discrepancies fluctuate over the four years, but tend on the whole to diminish towards, the base year" (p. 450). The authors warn, as we do, that in predicting *future* levels of output with the aid of input-output analysis "one must ensure consistency, and an acceptable standard of accuracy in the prediction of final expenditures before one can apply the method" (p. 454).

the forecasts of individual components of expenditure with this total and with the record of the distribution of expenditure in the light of our general expectations of the structure of expenditure. We also compared the forecasts of output and employment in individual industries with the total forecast and with the industrial distributions in the record again in the light of our general expectations. After considerable discussion we agreed substantially on the forecasts that have been presented in this book.

When we faced the question of forecasting changes in prices and relative prices in particular and the effects of these changes on patterns of expenditure, output and input, we were obliged to recognize that the library of knowledge on which we could draw had very bare shelves. Although prices have been the subject of endless economic analysis, the development of practical econometric techniques for assisting in the long-range forecasting of price changes leaves much to be desired. We recognized that in our consistency checks we should have to allow that many of the stresses and strains in the economy could be expected to result in changes in relative prices. But the formal framework within which to conduct a systematic analysis was lacking and, as explained in the text, resort was had to more informal methods that can only be described in the words of Sir Montague Norman as "feel and flair", and we are conscious that he had more feel and flair for the setting of bank rate than we had for judging the likely developments of relative prices in Canada in the next 25 years.

The obvious kind of model with which to work in handling questions of relative price changes, whether one wishes to consider how changes in relative prices will affect the other variables or how changes in real demands and supplies will affect relative prices, is a variation of the input-output model. Some authors have pioneered developments of the basic model in this direction.[3] But all of these developments are recent and pioneer developments, moreover, and this for us was decisive, since they involve variations of input-output analysis, they raise all of the problems of this type of analysis that we have described above, plus additional ones particular to the analysis of price change. This is the situation that led us regretfully to abandon any systematic attempt to forecast the changes in relative prices and their effects, though, as we mentioned, allowance for the effects of offsetting changes in the prices of particular kinds of goods or services was made in some instances more by feel than by figuring.

[3]Mention may be made of W. W. Leontief, *The Structure of the American Economy, 1919-1939*, New York, 1951, Part IV C; Richard Stone. "Transactions Models With an Example Based on the British National Accounts", *Accounting Research*, Vol. VI, 1955, pp. 1-24; and P. Norregaard Rasmussen, *Studies in Inter-Sectoral Relations*, Amsterdam, 1956.

PERCENTAGE DISTRIBUTION OF THE CIVILIAN EMPLOYED LABOUR FORCE BY INDUSTRIES, 1926-55

	Agriculture	Resource industries	Primary manu-facturing	Secondary manu-facturing	Con-struction	Transportation, storage and communi-cation	Trade, finance and services	Total business	Civilian government and community services
1926	34.9	5.3	5.1	14.7	4.1	8.2	20.4	57.8	7.3
1927	34.3	5.4	5.2	14.6	4.6	8.1	20.7	58.5	7.2
1928	33.3	5.7	5.1	15.0	4.5	8.2	21.0	59.5	7.2
1929	32.0	5.4	5.1	15.5	5.2	8.2	21.5	60.9	7.0
1930	31.2	5.4	4.5	15.2	5.7	8.0	22.4	61.2	7.6
1931	32.1	4.7	3.8	14.2	6.2	7.5	23.4	59.7	8.3
1932	34.6	4.3	3.6	13.6	4.5	6.9	23.6	56.5	8.9
1933	34.8	4.4	3.5	13.0	4.5	6.5	24.6	56.6	8.6
1934	33.4	5.0	3.7	13.5	5.9	6.3	23.8	58.2	8.4
1935	32.8	5.4	3.9	13.9	5.4	6.3	24.2	59.1	8.2
1936	32.3	5.4	4.0	13.8	5.4	6.3	24.8	59.6	8.1
1937	31.4	5.8	4.2	14.2	5.1	6.3	25.5	61.1	7.5
1938	32.5	5.6	4.2	14.4	4.9	6.3	24.1	59.4	8.1
1939	32.5	5.7	4.1	14.2	4.7	6.3	24.6	59.5	8.0
1940	30.6	5.6	4.4	15.6	5.2	6.1	24.9	61.5	7.9
1941	27,6	6.1	4.6	19.1	5.1	6.4	23.1	64.3	8.1
1942	24.5	5.5	4.9	22.6	5.1	6.6	22.9	67.6	8.0
1943	23.7	4.5	5.1	24.8	4.7	6.9	22.3	68.2	8.1
1944	24.1	4.3	5.4	24.5	3.6	7.1	22.4	67.3	8.7
1945	24.7	4.1	5.3	22.5	3.8	7.5	22.8	66.0	9.3
1946	25.3	4.6	5.7	20.4	4.9	7.4	22.4	65.4	9.3
1947	23.2	4.5	5.8	20.4	5.2	7.7	23.6	67.3	9.5
1948	22.4	4.7	5.8	20.2	5.9	7.6	23.4	67.6	9.9
1949	21.8	4.5	5.7	20.8	6.5	7.4	23.1	68.0	10.3
1950	20.4	4.8	5.7	20.8	6.8	7.6	23.4	69.0	10.7
1951	18.4	5.3	5.9	20.6	6.9	7.8	24.2	70.7	10.9
1952	17.2	5.2	5.7	20.2	6.7	8.2	25.8	71.7	11.2
1953	16.4	4.8	5.7	20.8	6.7	8.1	26.1	72.2	11.5
1954	16.8	5.1	5.8	19.5	6.4	7.6	26.7	71.1	12.1
1955	15.3	5.6	5.9	19.7	6.9	7.5	26.6	72.2	12.5

NOTE: Detail may not add to total because of rounding.
SOURCE: Chapter 5 Appendix F.

PERCENTAGE DISTRIBUTION OF THE GROSS DOMESTIC PRODUCT AT FACTOR COST, BY INDUSTRIES, 1926-55

(excluding residential rents and G.D.P. arising in the armed forces sector)

	Agriculture	Resource industries	Primary manu-facturing	Secondary manu-facturing	Con-struction	Transportation, storage and communi-cation	Trade, finance and services	Total business	Civilian government and community services
1926	26.3	6.4	5.3	15.7	4.8	8.7	23.6	64.5	9.2
1927	26.2	6.3	5.1	15.8	5.2	8.7	23.8	64.9	9.0
1928	25.2	6.2	5.1	16.0	5.6	9.1	24.1	66.1	8.7
1929	18.8	6.8	5.5	17.8	6.3	9.0	26.4	71.7	9.5
1930	23.2	6.8	5.3	16.1	5.9	8.1	24.6	66.7	10.1
1931	21.8	6.5	5.0	15.9	5.8	8.1	25.4	66.7	11.5
1932	27.8	6.1	4.6	14.2	4.1	7.5	23.9	60.4	11.8
1933	22.6	7.4	5.5	15.5	3.7	7.7	25.3	65.2	12.3
1934	22.3	8.1	6.0	16.6	2.9	7.5	23.9	66.0	11.7
1935	22.8	8.1	6.1	17.3	4.0	7.3	23.4	66.2	11.1
1936	19.9	8.7	6.6	18.2	4.3	7.6	23.8	69.3	10.8
1937	17.8	9.5	6.8	19.4	4.7	7.4	24.8	71.6	10.6
1938	22.5	8.6	6.2	17.4	4.5	7.1	22.8	66.4	11.1
1939	24.2	8.9	6.3	17.3	4.2	7.0	21.6	65.3	10.5
1940	22.2	9.1	6.6	19.8	4.3	7.7	20.5	68.0	9.8
1941	17.0	8.4	7.0	24.4	4.8	8.4	19.9	72.9	10.1
1942	21.8	7.2	6.5	26.6	4.3	8.0	17.2	69.8	8.4
1943	15.1	7.0	6.9	30.4	4.3	9.4	18.0	76.0	9.0
1944	17.7	6.5	6.7	30.3	3.3	9.0	17.9	73.7	8.6
1945	14.5	7.3	6.9	27.3	3.6	9.7	21.0	75.8	9.7
1946	15.5	7.3	7.1	22.2	4.6	8.6	24.2	74.0	10.5
1947	13.7	7.4	7.3	22.8	5.1	8.7	24.6	76.0	10.3
1948	14.2	7.8	7.3	22.8	5.6	8.6	23.5	75.6	10.2
1949	13.5	7.6	7.2	22.7	5.8	8.5	24.3	76.1	10.3
1950	14.0	8.0	7.2	22.4	5.7	8.3	24.3	75.9	10.1
1951	14.7	8.8	7.3	22.6	5.6	8.4	22.7	75.4	9.8
1952	15.3	8.5	6.9	22.1	5.8	8.6	22.9	74.8	9.9
1953	13.8	8.6	6.9	23.2	6.0	8.4	23.1	76.3	9.9
1954	11.5	9.6	7.4	22.0	6.3	8.3	24.3	77.9	10.6
1955	12.8	9.9	7.3	21.6	6.5	8.1	23.7	77.1	10.1

NOTE: Detail may not add to total because of rounding.
SOURCE: Chapter 5 Appendix F.

Chapter 7 Appendix D

THE DISTRIBUTION OF GROSS NATIONAL EXPENDITURE, 1926-55

The published figures of Gross National Expenditure in current dollars are:

1) 1926-49: in *National Accounts, Income and Expenditure—1926-1950*

2) 1950-55: in *National Accounts, Income and Expenditure—1950-1955*

The published figures on Gross National Expenditure in constant dollars are:

1) In 1935-39 dollars 1926-50: in *National Accounts, Income and Expenditure—1926-1950*

2) In 1949 dollars 1950-55: in *National Accounts, Income and Expenditure—1950-1955*

3) In 1935-39 dollars 1950-55: in *National Accounts, Income and Expenditure—1950-1955*

The current dollar figures given in Table 7D. 1 are the published figures for all years except 1926 to 1932 inclusive. For these years adjustments have been made in the figures for consumer expenditure on goods and services and for investment expenditures on machinery and equipment, and consequently in the figures for total Gross National Expenditure. The changes in consumer expenditure are discussed in the Commission's study of consumer expenditure. The changes in expenditures on machinery and equipment were discussed in Chapter 6.

The constant (1949) dollar figures given in Table 7D. 2 for 1950-55 are as published. Constant dollar figures for 1949 are the published current dollar figures for that year. For the years 1933-48 the figures are the result of a "mechanical conversion" of the published 1953-59 dollar series, the conversion being done at the level of gross components such as consumer

expenditure, government expenditure, exports, imports, etc., using the published implicit price indexes for these categories. The total GNE for these years is obtained by adding the converted components. The relative movements of the total from year to year are, therefore, not exactly equal to the relative year to year movements in total GNE in 1935-39 dollars as published. For the years 1926-32, components of expenditure other than consumer expenditures and investment expenditures on machinery and equipment have been derived by the mechanical conversion as for the years 1933-48. For total consumer expenditures and for expenditure on machinery and equipment, the procedure was to use the published indexes of prices for these goods and services, converted to a 1949 base, to deflate the adjusted current dollar series. Total investment expenditures excluding inventories were then derived as the sum of the constant dollar figures of expenditure on new residential construction, new non-residential construction and machinery and equipment.

In Tables 7D. 3 and 7D. 4, the data from Tables 7D. 1 and 7D. 2 have been used.

Table 7D. 1

DISTRIBUTION OF GROSS NATIONAL EXPENDITURE IN CURRENT DOLLARS, 1926-55

(millions)

	Personal expenditure on consumer goods and services				Government expenditures on goods and services	Investment (ex. inventories)				Change in inventories		External trade				
	Total	Non-durables	Durables	Services		Total	Residential construction	Non-residential construction	Machinery and equipment	Total	Business	Exports less imports	Exports	Imports	Residual error	G.N.E.
1926.....	3,785	2,149	297	1,339	521	714	212	240	262	+ 88	+ 89	+128	1,650	1,522	+ 58	5,294
1927.....	4,042	2,337	318	1,387	567	844	217	299	328	+ 218	+ 158	— 11	1,618	1,629	— 13	5,647
1928.....	4,327	2,490	378	1,459	597	1,023	236	411	376	+ 157	+ 179	— 35	1,773	1,808	+ 36	6,105
1929.....	4,531	2,597	398	1,536	682	1,175	247	486	442	+ 61	+ 190	—313	1,632	1,945	+ 30	6,166
1930.....	4,342	2,503	326	1,513	767	937	204	381	352	— 154	— 200	—339	1,286	1,625	— 7	5,546
1931.....	3,773	2,132	248	1,393	738	629	168	264	197	— 290	— 260	—175	967	1,142	—115	4,560
1932.....	3,199	1,798	168	1,233	643	325	96	121	108	— 216	— 230	— 97	804	901	— 87	3,767
1933.....	2,887	1,609	150	1,128	526	239	76	79	84	— 82	— 49	— 2	826	828	— 16	3,552
1934.....	3,077	1,758	194	1,125	568	306	98	92	116	+ 70	+ 78	+ 70	1,018	948	— 57	4,034
1935.....	3,243	1,830	229	1,184	603	378	114	118	146	+ 47	+ 48	+126	1,143	1,017	— 52	4,345
1936.....	3,457	1,962	259	1,236	600	469	139	150	180	— 50	+ 6	+245	1,428	1,183	— 20	4,701
1937.....	3,777	2,154	313	1,310	671	647	176	190	281	+ 94	+ 105	+182	1,591	1,409	— 16	5,355
1938.....	3,815	2,145	291	1,379	720	605	159	171	275	— 10	— 38	+ 99	1,356	1,257	+ 4	5,233
1939.....	3,904	2,210	292	1,402	735	605	185	166	254	+ 331	+ 271	+123	1,451	1,328	+ 9	5,707
1940.....	4,399	2,520	361	1,518	1,165	818	200	210	408	+ 369	+ 294	+179	1,808	1,629	— 58	6,872
1941.....	5,053	3,032	390	1,631	1,689	1,078	233	288	557	+ 247	+ 295	+491	2,467	1,976	— 41	8,517
1942.....	5,514	3,465	295	1,754	3,726	1,044	194	354	496	+ 316	38	+ 54	2,361	2,307	—115	10,539
1943.....	5,727	3,673	278	1,776	4,227	845	174	366	305	— 109	+ 16	+527	3,444	2,917	— 34	11,183
1944.....	6,187	3,928	296	1,963	5,022	859	225	257	377	— 46	+ 57	— 8	3,561	3,569	— 60	11,954
1945.....	6,811	4,327	338	2,146	3,704	986	272	252	462	— 260	— 29	+687	3,597	2,910	— 78	11,850
1946.....	7,977	5,073	590	2,314	1,832	1,398	371	443	584	+ 519	+ 576	+332	3,210	2,878	— 32	12,026
1947.....	9,173	5,776	852	2,545	1,570	2,121	506	599	1,016	+ 947	+1,026	+ 17	3,638	3,621	— 60	13,768
1948.....	10,112	6.461	914	2,737	1,798	2,685	637	818	1,230	+ 605	+ 670	+418	4,054	3,636	— 5	15,613
1949.....	10,963	6,799	1,084	3,080	2,128	2,968	742	903	1,323	+ 231	+ 303	+174	4,011	3,837	— 2	16,462
1950.....	12,029	7,241	1,343	3,445	2,326	3,216	801	1,026	1,389	+ 960	+ 769	— 330	4,183	4,513	+ 2	18,203
1951.....	13,273	7,969	1,399	3,905	3,243	3,810	781	1,260	1,769	+1,620	+1,267	—524	5,089	5,613	+ 52	21,474
1952.....	14,366	8,374	1,588	4,404	4,245	4,256	786	1,554	1,916	+ 310	— 18	+173	5,573	5,400	— 95	23,255
1953.....	15,112	8,581	1,790	4,741	4,388	4,840	1,061	1,706	2,073	+ 591	+ 395	—443	5,400	5,843	— 15	24,473
1954.....	15,823	8,991	1,694	5,138	4,418	4,666	1,166	1,659	1,841	— 270	— 140	—427	5,147	5,574	+107	24,317
1955.....	16,888	9,469	1,901	5,518	4,738	5,268	1,476	1,775	2,017	+ 508	+ 317	—677	5,753	6,430	+ 44	26,769

Table 7D. 2

DISTRIBUTION OF GROSS NATIONAL EXPENDITURE IN CONSTANT DOLLARS, 1926-55

(millions)

			Investment (ex. inventories)				Change in inventories		External trade				
	Consumer expenditure	Government expenditure	Total	Residential construction	Non-residential construction	Machinery and equipment	Total	Business	Exports less imports	Exports	Imports	Residual error	G.N.E.
1926	5,199	785	1,256	442	399	415	223	226	+124	2,402	2,278	+83	7,670
1927	5,677	856	1,488	451	497	540	446	330	—128	2,429	2,557	—19	8,320
1928	6,060	895	1,769	479	668	622	285	340	—137	2,770	2,907	+52	8,924
1929	6,302	1,013	1,962	479	768	715	13	258	—553	2,615	3,168	+43	8,780
1930	6,090	1,148	1,625	406	625	594	327	41	—607	2,305	2,912	—10	8,573
1931	5,805	1,135	1,172	359	467	346	—354	—194	—237	2,098	2,335	—182	7,339
1932	5,377	1,037	638	224	224	190	—123	—200	+ 48	1,937	1,889	—152	6,825
1933	5,065	853	488	189	150	149	—284	—133	+121	1,953	1,832	— 29	6,214
1934	5,324	924	612	231	173	208	31	61	+242	2,189	1,947	—100	7,033
1935	5,591	973	746	270	219	257	105	67	+295	2,427	2,132	— 91	7,619
1936	5,869	971	905	320	271	314	—251	—133	+463	2,897	2,434	—34	7,923
1937	6.212	1,072	1,154	378	318	458	53	86	+262	2,946	2,684	—26	8,727
1938	6,163	1,156	1,090	349	292	449	282	161	+151	2,685	2,534	+ 7	8,849
1939	6.338	1,195	1,104	402	287	415	687	530	+301	2,973	2,672	+15	9,640
1940	6,841	1,809	1,380	409	350	621	680	419	+417	3,342	2,925	—92	11,035
1941	7,344	2,525	1,672	428	455	789	33	236	+1,051	4,366	3,315	— 62	12,563
1942	7,658	5,056	1,531	329	521	681	702	—241	+ 396	3,870	3,474	—163	15,180
1943	7,760	5,666	1,188	273	516	399	—287	— 89	+1,292	5,424	4,132	— 48	15,571
1944	8,338	6,447	1,193	335	357	501	—218	13	+ 283	5,206	4,923	— 81	15,962
1945	9,069	4,534	1,372	395	349	628	—501	—119	+1,041	5,066	4,025	—102	15,413
1946	10,266	2,389	1,865	503	578	784	400	486	+258	4,137	3,879	— 41	15,137
1947	10,741	1,851	2,531	616	701	1,214	419	548	—157	4,088	4,245	— 70	15,315
1948	10,555	1,915	2,829	677	850	1,302	154	159	+432	4,188	3,756	— 52	15,833
1949	10,963	2,128	2,968	742	903	1,323	48	175	+174	4,011	3,837	— 2	16,279
1950	11,645	2,216	3,047	760	970	1,317	591	450	—176	4,034	4,210	+ 2	17,325
1951	11,572	2,760	3,205	650	1,061	1,484	1,056	682	—299	4,406	4,705	+ 46	18,340
1952	12,237	3,462	3,484	635	1,223	1,626	485	197	— 2	4,872	4,874	— 79	19,587
1953	12,905	3,452	3,844	832	1,287	1,735	+584	328	—441	4,856	5,297	— 12	20,332
1954	13,375	3,357	3,678	910	1,250	1,518	—266	—60	—387	4,671	5,058	+ 87	19,844
1955	14,300	3,481	4,044	1,122	1,294	1,628	+436	160	—723	4,998	5 721	+ 35	21,573

Table 7D. 3

PERCENTAGE DISTRIBUTION OF GROSS NATIONAL EXPENDITURE IN CURRENT DOLLARS, 1926-55

	Personal expenditure on consumer goods and services				Government expenditures on goods and services	Investment (ex. inventories)				Change in inventories		External trade				
	Total	Non-durables	Durables	Services		Total	Residential construction	Non-residential construction	Machinery and equipment	Total	Business	Exports less imports	Exports	Imports	Residual error	G.N.E.
1926.....	71.5	40.6	5.6	25.3	9.8	13.5	4.0	4.5	4.9	1.7	1.7	2.4	31.2	28.7	+1.1	5,294
1927.....	71.6	41.4	5.6	24.6	10.0	14.9	3.8	5.3	5.8	3.9	2.8	—0.2	28.7	28.8	—0.2	5,647
1928.....	70.9	40.8	6.2	23.9	9.8	16.8	3.9	6.7	6.2	2.6	2.9	—0.6	29.0	29.6	+0.6	6,105
1929.....	73.5	42.1	6.5	24.9	11.1	19.1	4.0	7.9	7.2	+1.0	3.1	—5.1	26.5	31.5	+0.5	6.166
1930.....	78.3	45.1	5.9	27.3	13.8	16.9	3.7	6.9	6.3	—2.8	—3.6	—6.1	23.2	29.3	—0.1	5,546
1931.....	82.7	46.8	5.4	30.5	16.2	13.8	3.7	5.8	4.3	—6.4	—5.7	—3.8	21.2	25.0	—2.5	4,560
1932.....	84.9	47.7	4.5	32.7	17.1	8.6	2.5	3.2	2.9	—5.7	—6.1	—2.6	21.3	23.9	—2.3	3,767
1933.....	81.3	45.3	4.2	31.8	14.8	6.7	2.1	2.2	2.4	—2.3	—1.4	—0.1	23.3	23.3	—0.5	3,552
1934.....	76.3	43.6	4.8	27.9	14.1	7.6	2.4	2.3	2.9	+1.7	+1.9	+1.7	25.2	23.5	—1.4	4,034
1935.....	74.6	42.1	5.3	27.2	13.9	8.7	2.6	2.7	3.4	+1.1	+1.1	+2.9	26.3	23.4	—1.2	4,345
1936.....	73.5	41.7	5.5	26.3	12.8	10.0	3.0	3.2	3.8	—1.1	+0.1	+5.2	30.4	25.2	—0.4	4,701
1937.....	70.5	40.2	5.8	24.5	12.5	12.1	3.3	3.5	5.2	+1.8	+2.0	+3.4	29.7	26.3	—0.3	5,355
1938.....	72.9	41.0	5.6	26.4	13.8	11.6	3.0	3.3	5.3	—0.2	—0.7	+1.9	25.9	24.0	+0.1	5,233
1939.....	68.4	38.7	5.1	24.6	12.9	10.6	3.2	2.9	4.5	+5.8	+4.7	+2.2	25.4	23.3	+0.2	5,707
1940.....	64.0	36.7	5.3	22.1	17.0	11.9	2.9	3.1	5.9	+5.4	+4.3	+2.6	26.3	23.7	—0.8	6,872
1941.....	59.3	35.6	4.6	19.1	19.8	12.7	2.7	3.4	6.5	+2.9	+3.5	+5.8	29.0	23.2	—0.5	8,517
1942.....	52.3	32.9	2.8	16.6	35.4	9.9	1.8	3.4	4.7	+3.0	+0.4	+0.5	22.4	21.9	—1.1	10,539
1943.....	51.2	32.8	2.5	15.9	37.8	7.6	1.6	3.3	2.7	—1.0	+0.1	+4.7	30.8	26.1	—0.3	11,183
1944.....	51.8	32.9	2.5	16.4	42.0	7.2	1.9	2.1	3.2	—0.4	+0.5	—0.1	29.8	29.9	—0.5	11,954
1945.....	57.5	36.5	2.9	18.1	31.3	8.3	2.3	2.1	3.9	—2.2	—0.2	+5.8	30.4	24.6	—0.7	11,850
1946.....	66.3	42.2	4.9	19.2	15.2	11.6	3.1	3.7	4.9	+4.3	+4.8	+2.8	26.7	23.9	—0.3	12,026
1947.....	66.6	42.0	6.2	18.5	11.4	15.4	3.7	4.4	7.4	+6.9	+7.5	+0.1	26.4	26.3	—0.4	13,768
1948.....	64.8	41.4	5.9	17.5	11.5	17.2	4.1	5.2	7.9	+3.9	+4.3	+2.7	26.0	23.3	—0.03	15,613
1949.....	66.6	41.3	6.6	18.7	12.9	18.0	4.5	5.5	8.0	+1.4	+1.8	+1.1	24.4	23.3	—0.01	16,462
1950.....	66.1	39.8	7.4	18.9	12.8	17.7	4.4	5.6	7.6	+5.3	+4.2	—1.8	23.0	24.8	+0.01	18,203
1951.....	61.8	37.1	6.5	18.2	15.1	17.7	3.6	5.9	8.2	+7.5	+5.9	—2.4	23.7	26.1	+0.2	21,474
1952.....	61.8	36.0	6.8	18.9	18.3	18.3	3.4	6.7	8.2	+1.3	—0.1	+0.7	24.0	23.2	—0.4	23,255
1953.....	61.7	35.1	7.3	19.4	17.9	19.8	4.3	7.0	8.5	+2.4	+1.6	—1.8	22.1	23.9	—0.06	24,473
1954.....	65.1	37.0	7.0	21.1	18.2	19.2	4.8	6.8	7.6	—1.1	—0.6	—1.8	21.2	22.9	+0.4	24,317
1955.....	63.1	35.4	7.1	20,6	17.7	19.6	5.5	6.6	7.5	+1.9	+1.2	—2.5	21.5	24.0	+0.2	26,769

Table 7D. 4

PERCENTAGE DISTRIBUTION OF GROSS NATIONAL EXPENDITURE IN CONSTANT DOLLARS, 1926-55

			Investment (ex. inventories)				Change in inventories		External trade				
	Consumer expenditure	Government expenditure	Total	Residential construction	Non-residential construction	Machinery and equipment	Total	Business	Exports less imports	Exports	Imports	Residual error	G.N.E.
1926	67.8	10.2	16.4	5.8	5.2	5.4	2.9	2.9	+1.6	31.3	29.7	+1.1	7,670
1927	68.2	10.3	17.9	5.4	6.0	6.5	5.4	4.0	—1.5	29.2	30.7	—0.2	8,320
1928	67.9	10.0	19.8	5.4	7.5	7.0	3.2	3.8	—1.5	31.0	32.6	+0.6	8,924
1929	71.8	11.5	22.3	5.5	8.7	8.1	0.1	2.9	—6.3	29.8	36.1	—0.5	8,780
1930	71.0	13.4	19.0	4.7	7.3	6.9	3.8	0.5	—7.1	26.9	34.0	0.1	8,573
1931	79.1	15.5	16.0	4.9	6.4	4.7	—4.8	—2.6	—3.2	28.6	31.8	2.5	7,339
1932	78.8	15.2	9.3	3.3	3.3	2.8	—1.8	—2.9	+0.7	28.4	27.7	—2.2	6,825
1933	81.5	13.7	7.8	3.0	2.5	2.4	—4.5	—2.1	+1.9	31.4	29.5	—0.5	6,214
1934	75.7	13.1	8.8	3.3	2.5	3.0	+0.5	+0.9	+3.4	31.1	27.7	—1.4	7,033
1935	73.4	12.8	9.8	3.5	2.9	3.4	+1.4	+0.9	+3.9	31.9	28.0	—1.2	7,619
1936	74.1	12.3	11.4	4.0	3.4	4.0	—3.1	—1.6	+5.9	36.6	30.7	—0.4	7,923
1937	71.2	12.3	13.1	4.3	3.6	5.2	+0.5	+0.9	3.2	33.8	30.6	—0.3	8,727
1938	69.6	13.1	12.3	3.9	3.3	5.1	+3.2	1.8	1.7	30.3	28.6	+0.1	8,849
1939	65.7	12.4	11.5	4.2	3.0	4.3	+7.1	5.5	3.1	30.8	27.7	+0.2	9,640
1940	62.0	16.4	12.5	3.7	3.2	5.6	+6.2	3.8	3.8	30.3	26.5	—0.8	11,035
1941	58.5	20.1	13.3	3.4	3.6	6.3	+0.3	1.9	8.4	34.8	26.4	— .5	12,563
1942	50.4	33.3	10.1	2.2	3.4	4.5	+4.8	—1.4	—2.6	25.5	22.9	— .1	15,180
1943	49.8	36.4	7.7	1.8	3.3	2.6	—1.9	—0.6	8.3	34.8	26.5	— .3	15,571
1944	52.2	40.4	7.4	2.1	2.2	3.1	—1.2	+0.1	1.8	32.6	30.8	— .5	15,962
1945	58.8	29.4	9.0	2.6	2.3	4.1	—3.3	—0.8	6.8	32.9	26.1	— .7	15,413
1946	67.8	15.8	12.3	3.3	3.8	5.2	+2.6	3.2	1.7	27.3	25.6	— .3	15,137
1947	70.1	12.1	16.5	4.0	4.6	7.9	+2.8	3.6	—1.0	26.7	27.7	— .5	15,315
1948	66.7	12.1	17.9	4.3	5.4	8.2	+1.0	1.0	2.8	26.5	23.7	— .3	15,833
1949	67.3	13.1	18.2	4.6	5.5	8.1	0.3	1.1	1.1	24.6	23.6	— .01	16,279
1950	67.2	12.8	17.6	4.4	5.6	7.6	+3.4	2.6	—1.0	23.3	24.3	+ .01	17,325
1951	63.1	15.0	17.4	3.5	5.8	8.1	+5.7	3.7	—1.7	24.0	25.7	+ .0	18,340
1952	62.5	17.7	17.8	3.2	6.2	8.3	2.5	1.0	—0.01	24.9	24.9	— .0	19,587
1953	63.5	17.0	18.9	4.1	6.3	8.5	2.9	1.6	—2.2	23.9	26.1	— .0	20,332
1954	67.4	16.9	18.5	4.6	6.3	7.6	—1.3	—0.3	—2.0	23.5	25.5	+ .0	19,844
1955	66.3	16.1	18.7	5.2	6.0	7.5	+2.0	+0.7	—3.4	23.2	26.5	+ .0	21,573

Table 7E. 1

THE DIVISION OF SAVING, 1926-55

(millions of current dollars)

	Personal saving	Undistributed corporation profits	Depreciation allowances and similar business costs	Net bad debt losses and other adjustments	Gross business saving	Government receipts less expenditures	Government non-defence investment expenditures	Total government saving	Imports less exports of goods and services	Error of estimates	Total saving
1926......	352	179	558	2	739	56	108	164	—128	—61	1,066
1927......	327	217	600	—26	791	47	138	185	11	— 4	1,310
1928......	365	263	659	— 1	921	84	160	244	35	—56	1,509
1929......	196	211	709	—21	899	9	188	197	313	—13	1,592
1930......	88	—	684	39	723	—222	233	11	339	—14	1,147
1931......	—17	—119	618	—47	452	—311	188	—123	175	52	539
1932......	—107	—172	566	—28	366	—277	129	—148	97	34	242
1933......	—113	—77	547	—60	410	—174	88	—86	2	16	229
1934......	12	47	503	—40	510	—190	110	—80	— 70	57	429
1935......	50	68	520	—19	569	—172	127	—45	—126	52	500
1936......	25	139	534	—40	633	—34	121	87	—245	20	520
1937......	153	218	572	—20	770	—33	181	148	—182	17	906
1938......	160	108	581	5	694	—152	168	16	— 99	— 4	767
1939......	304	272	610	—68	814	—41	160	119	—123	— 9	1,105
1940......	409	163	720	20	903	—63	230	167	—179	59	1,359
1941......	547	273	858	—10	1,121	65	385	450	—491	42	1,669
1942......	1,466	355	1,002	—78	1,279	—1,561	476	—1,085	— 54	115	1,721
1943......	1,751	320	988	—88	1,220	—1,777	553	—1,224	—527	35	1,255
1944......	1,977	341	957	—24	1,274	—2,566	425	—2,141	8	60	1,178
1945......	1,619	349	928	47	1,324	—1,687	298	—1,389	—687	79	946
1946......	988	411	903	15	1,329	—133	305	172	—332	33	2,190
1947......	426	619	1,118	28	1,765	773	368	1,141	17	61	3,376
1948......	1,009	788	1,276	—121	1,943	746	590	1,336	—418	5	3,875
1949......	1,005	607	1,437	—119	1,925	440	527	967	—174	1	3,724
1950......	645	844	1,636	76	2,556	648	599	1,247	330	— 1	4,777
1951......	1,390	721	1,910	—64	2,567	1,053	767	1,820	524	—52	6,249
1952......	1,525	667	2,120	—51	2,736	288	1,029	1,317	173	95	5,500
1953......	1,588	754	2,418	—25	3,147	223	1,001	1,224	443	15	6,417
1954......	965	624	2,673	—30	3,267	—49	954	905	427	—107	5,457
1955......	1,312	905	2,865	— 5	3,765	109	1,262	1,371	677	—43	7,082

SOURCE: D.B.S., *National Accounts: Income and Expenditure.*

Chapter 7, Appendix E

Table 7E. 2

THE DIVISION OF SAVING, 1926-55

(percentage)

	Personal saving	Undis-tributed corporation profits	Depreciation allowances and similar business costs	Net bad debt losses and other adjustments	Gross business saving	Government receipts less expenditures	Government non-defence investment expenditures	Total government saving	Imports less exports of goods and services	Error of estimate
1926.......	33.0	16.8	52.3	.2	69.3	5.3	10.1	15.4	—12.0	—5.7
1927.......	25.0	16.6	45.8	—2.0	60.4	3.6	10.5	14.1	.8	— .4
1928.......	24.2	17.4	43.7	— .1	61.0	5.6	10.6	16.2	2.3	—3.7
1929.......	12.3	13.3	44.5	—1.3	56.5	.6	11.8	12.4	19.7	— .8
1930.......	7.7	—	59.6	3.4	63.0	—19.4	20.3	1.0	29.6	—1.2
1931.......	— 3.2	—22.1	114.7	— 8.7	83.9	—57.7	34.9	—22.8	32.5	9.7
1932.......	—44.2	—71.1	233.9	—11.6	151.2	—114.5	53.3	—61.2	40.1	14.1
1933.......	—49.3	—33.6	238.9	—26.2	179.0	—76.0	38.4	—37.6	.9	7.0
1934.......	2.8	11.0	117.3	—9.3	118.9	—44.3	25.6	—18.7	—16.3	13.3
1935.......	10.0	13.6	104.0	—3.8	113.8	—34.4	25.4	—9.0	—25.2	10.4
1936.......	4.8	26.7	102.7	—7.7	121.7	—6.5	23.3	16.7	—47.1	3.9
1937.......	16.9	24.1	63.1	—2.2	70.1	—3.6	20.0	16.3	—20.1	1.9
1938.......	20.9	14.1	75.8	.7	90.5	—19.8	21.9	2.1	—12.9	— .5
1939.......	27.5	24.6	55.2	— .6	79.2	— .4	14.5	14.1	—11.1	— .8
1940.......	30.1	12.0	53.0	1.5	66.4	—4.6	16.9	12.2	—13.2	4.3
1941.......	32.8	16.4	51.4	— .6	67.7	3.9	23.1	27.0	29.4	—2.5
1942.......	85.2	20.6	58.2	—4.5	74.3	—90.7	27.7	—63.0	—3.1	6.7
1943.......	139.5	25.5	78.7	—7.0	97.2	—141.6	44.1	—97.5	—42.0	2.8
1944.......	167.8	29.0	81.2	—2.0	108.2	—217.8	36.1	—181.8	.7	5.1
1945.......	171.1	36.9	98.1	5.0	140.0	—178.3	31.5	—38.3	—72.6	8.4
1946.......	45.1	18.8	41.2	.7	60.7	—6.1	13.9	7.9	—15.2	1.5
1947.......	12.6	18.3	33.1	.3	52.3	22.9	10.9	33.8	— .5	1.8
1948.......	26.0	20.3	32.9	—3.1	50.2	19.3	15.2	34.5	—10.8	.1
1949.......	27.0	16.3	38.6	—3.2	51.7	11.8	14.2	26.0	— 4.7	—
1950.......	13.5	17.7	34.3	1.6	53.5	13.6	12.5	26.1	6.9	—
1951.......	22.2	11.5	30.6	—1.0	41.1	16.9	12.3	29.1	8.4	— .8
1952.......	27.7	12.1	38.6	— .9	49.8	5.2	18.7	24.0	—3.2	1.7
1953.......	24.8	11.8	37.7	—.4	49.0	3.5	15.6	19.1	6.9	.2
1954.......	17.7	11.4	49.0	—.6	59.9	—.9	17.5	16.6	7.8	—2.0
1955.......	18.5	12.8	40.5	—.1	53.2	1.5	17.8	19.4	9.6	—.6

NOTE: Detail may not add to total because of rounding.
SOURCE: Table 7E. 1.

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[1]This is one of a series of three studies on Canadian international economic relations prepared under the direction of S. S. Reisman.

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